AMERICAN MACHINIST

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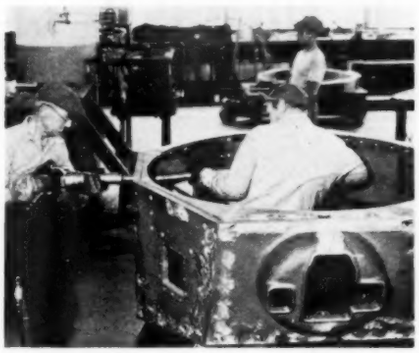

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featuring

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WHAT'S IN THIS ISSUE

MANY TANKS

During the present war so much emphasis has been placed on planes that we're inclined to overlook other elements of a mechanized military force. As information begins to trickle out of France, we are forced more and more to the conclusion that Hitler's astonishing advance owed much of its success to skillful coordination of all mechanized units. And so, while we should not slacken efforts to boost plane output, we should also exert great efforts to produce *balanced* mechanized forces. Prominent in such forces are tanks.

Like other machines of war, tanks have their own production difficulties. Armor plate, for instance, by its very nature presents many tough fabrication problems. And to a host of other manufacturing difficulties are often added those caused by frequent design changes. Even for Rock Island Arsenal, turning out tough tanks is hardly child's play.

So that American industry can familiarize itself with the problems of tank manufacture, this issue's Armament Section is devoted to the Rock Island production methods as applied to the M-2 medium tank. On page 709 Uncle Sam takes you on a tour through the arsenal, so that when, as and if you find yourself with a tank contract, you'll be better prepared to get into production.

R. RANDALL IRWIN
. . . still needs more men

WHAT—NO GRAVY?

A tremendous amount of misunderstanding has arisen from the aircraft industry's pleas for workers. One friend of ours, fresh from college, became furious at being offered no more than the typical beginner's wage. A garage mechanic of our acquaintance was "positive" he could drag down $100 a week in Paterson or Hartford, and only fruitless interviews convinced him he should keep on tinkering with cars. And now and then we get a hot letter from some unemployed old timer damning us for saying that the aircraft companies need men. To all these and others too we recommend the article beginning on page 695, which repeats that the aircraft industry *does* need men, and needs them badly. But not just any kind of men. In it R. Randall Irwin, Lockheed's industrial relations manager, explains his company's particular personnel problems and what's been done to meet them. It should be an eye-opener to all job-seekers hungering to lap up some aircraft gravy.

TRICKY FIXTURES

With increasing attention being paid to squeezing the utmost production from existing equipment, further emphasis is being laid on fixtures. On page 697 is discussed a rather unusual phase of fixture usage. It deals with induction hardening of small parts—a process usually requiring special machines to be built for each part to be treated. But with a basic machine, *and* proper fixtures, many small parts, in small lots, can now have the benefits of induction hardening. Frank W. Curtis, of Van Norman Machine Tool, gives the details.

SERIAL

Part four of C. C. Street's series on measurement for production, which you'll find on page 700, also deals with fixtures. This installment outlines ways to use dial gages for inspection and production, when built into specially designed fixtures. Fundamental design principles are given, with specific examples making various points clear. Their proper application can often result in more accurate fixtures involving less time, trouble and expense. Which ought to prove helpful in turning that tough inspection job into a considerably easier one.

NO EXCUSE

Though everyone seems to be well aware that accidents do not merely "happen," few persons ever get right down to the basic causes. To our mind one of those few is Edward Kann, who for fifteen years was in charge of the parts production department of Philips Radio Company, Eindhoven, Holland. A frequent visitor to the United States, Mr. Kann

EDWARD KANN
. . . left in a hurry

had just sailed from Holland when the Nazi invasion took place. With him was a bang-up article on how Philips had completely eliminated power press accidents. You'll find it on page 702, illustrated with photographs enlarged from 16-mm. movie film, the only pictures available in Mr. Kann's hurried departure.

COMING

The third AMERICAN MACHINIST Armament Section will be devoted to the manufacture of cartridge cases. This will be another of those "this is how *you* can do it" articles which, we fervently hope, will prove of value in speeding the defense program. Like this issue's section on tanks, it will be detailed, exhaustive and authoritative.

Also scheduled for an early number is a discussion of infra-red baking principles. This is a jammed-with-data type of article you won't want to miss. Look for it soon in AMERICAN MACHINIST.

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Wanted: Skilled Men

By R. RANDALL IRWIN
Industrial Relations Manager
Lockheed Aircraft Corporation

The aircraft industry is crying for skilled men, so lines like this form outside plane plants. But less than one quarter of these applicants, on the average, have any experience. Lockheed men go down this line every morning, forming a separate line of the few claiming craftsmanship. They might land jobs in the toolroom. Some of the rest may be eligible for semi-skilled production jobs after a few weeks of training

ABOUT 80 PER CENT of aircraft workers fall within the semi-skilled classification. Such men as riveters and sheet-metal workers can be trained in a relatively short time, generally from three to six weeks. But the other 20 per cent must be skilled, experienced, all-round men. During the expansion period a major part of aircraft work is devoted to tooling. For such work men most needed are versatile machinists of the job shop type, tool and die makers, and others highly skilled.

We at Lockheed have attacked the problem on three fronts: (1) We are making an energetic and scientific effort to obtain all skilled machine men who may still be available. (2) We are finding ways to make the best of such men. (3) We are conducting a vigorous long-term training program to provide properly trained men for the future.

First line of attack is to search out all available talent. We start by keeping in close touch with all known sources of skilled craftsmen and following all leads on semi-skilled men and specialists. Sources include trade schools, public schools and employment agencies. Although few all-round craftsmen are available from such sources, we receive many specialists by cards of introduction and such men are immediately interviewed, tested, and hired if found qualified to perform some phase of our work. About half of our new workers in the craft lines come to us in this way, and the other half are sifted out of the applicants for employment who daily besiege our front gate.

To "streamline" the obtaining of qualified craftsmen we follow a careful plan of selection off the employment line. Normally several hundred men are lined up outside the employment office at the day's start. We first go down the line and form a new line of men claiming to be skilled workers. During the first hour we usually separate about 25 per

cent of the applicants in this way. Engineers and draftsmen are employed through a separate procedure which takes them direct to the engineering section of the employment division.

From our line we pick tool and die makers, machinists, welders, auto mechanics, power hammer operators, jig and fixture builders, plumbers, millwrights, precision assemblymen, and various other skilled workers. Each day we are supplied with the personnel requirements of the various departments. These are listed in convenient form and supplied to the interviewers. Such lists show the interviewer what department is requisitioning labor, what classification of worker is required and what quantities of such workers are needed. Armed with this information, interviewers work the line of skilled applicants to select those most likely to fill our requirements. A carefully developed set of test questions, plus knowledge of trade requirements on the part of the various interviewers, helps these men eliminate bluffers.

Selected men are passed on to the personnel testing section for temperament, dexterity, aptitude and trade knowledge tests. These tests have been developed by experts and quickly catch anyone who may have bluffed his way past the preliminary interview.

A final interview is then given to all men who have come through the selection process successfully. This interview determines such matters as assignment to a specific department, agreement as to wage rate, informing of the applicant as to work, etc.

After we have done our best on the hiring line to obtain men for machine work and other skilled occupations, there is still the problem of keeping production going in cases where the employment division has not been able to provide sufficient skilled men. This is a real problem, especially in such departments as tool making, as there is no satisfactory substitute for skilled tool makers. Also, as the factory expands we find that an increasing number of craftsmen must be promoted to supervisory jobs. However, we use the capabilities of the supervisory personnel to the limit in encouraging development of men whose skill may be in the lower brackets. We maintain a special school for supervisors to help them speed up this advancement process. Ordinary machinists are encouraged to learn tool and die work. Machine operators or those who are rusty from lack of employment are encouraged to broaden their skill and so progress to more exacting work. Wherever possible, skilled all-round men are diluted with less skilled men. In this way the whole body of skilled workers moves steadily toward higher ratings, making it possible to feed less skilled men into the shop lower down the line.

As to the long-term program, Lockheed has, with the help of the Federal Committee on Apprenticeship, the California State Bureau of Trade & Industrial Education, Burbank Unified Schools System, California Apprenticeship Council, and employee representatives, developed a vigorous apprentice training program directed toward employment of men between the ages of 18 and 23 years.

Another phase of the training program is handled as a mass problem. Under a public school trade extension program some 53 different night classes devoted largely to shop work are attended by about 50 per cent of the Lockheed day shift employees. From classes and outside applicants, apprentice candidates are selected. The apprenticeship covers a period of four years, and the agreement requires a minimum of 144 hours a year to be spent in school during the term of the indenture. Subjects taught include trade mathematics, shop drafting, blue-print reading, materials and processes, etc. The work week consists of 36 hours in the factory and 4 hours of classroom instruction, for which the apprentice receives full wages at his regular rate. The first class under this plan was inaugurated last February and the apprentice program has since been materially expanded. The plan calls for training one apprentice to every ten journeymen.

In this program the man is thoroughly trained not only as a specialist but in all phases of his trade. This assures his future employment as well as making him an accomplished aeronautical craftsman. Apprenticeship training is divided into eight classifications as follows: Aircraft machinist, aircraft tool and jig builder, aircraft wood pattern and wood jig builder, aircraft sheet metal, aircraft electrical trade, aircraft welder and metal fitter, aircraft painting and processing, and aircraft upholsterer and trimmer. Scope of the training may be judged by suggested hours of work experience for the aircraft machinist apprentice: hand bench, 300; drill press, 500; turret lathe, 500; engine lathe, 1,800; milling machine, 1,000; planer, 300; shaper, 500; turret lathe job setter, 500; precision grinding, 200; tool grinding, 700; bench machinist, 1,000; inspection, 200; office, tabulating, operation sheets, office system, etc., 320; and additional work on above operations as required, 500. This totals 8,320 hours. Each apprentice undergoes this minimum amount of training, with the work varied to meet his particular capabilities.

By these methods Lockheed Aircraft Corporation is doing all in its power to meet the need for the vital 20 per cent of trained men in the aircraft industry if production is to be expanded as required. So far we have been able to meet every demand successfully. And we believe our program is equal to any task that may be imposed in the future.

Cynical indeed become rusty old-timers, mediocre garage mechanics and high-school kids when they find they can't get high-paid jobs in the aircraft industry. It's men like this, capable of getting the utmost out of precision toolroom machines, who are received with open arms

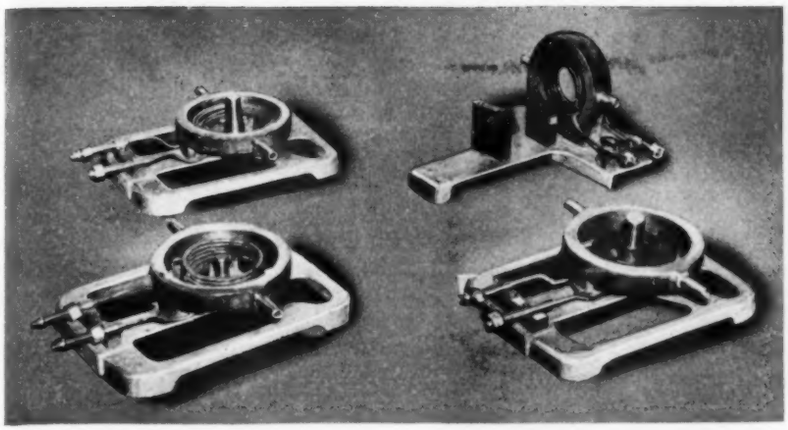
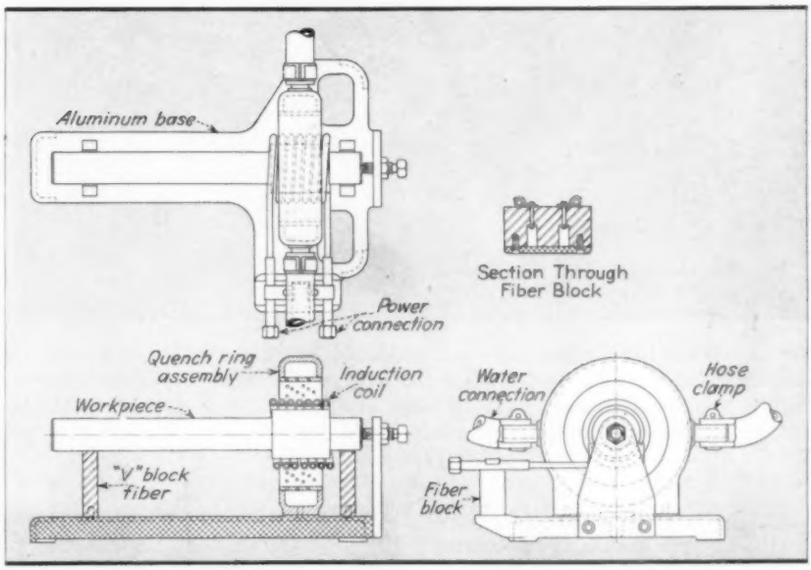


Fig. 1—A fixture is made up from standard parts for each production item to be hardened. Here are shown three vertical-type and one horizontal fixture, each arranged for hardening a single surface on some specific part

Holding for hardening

Fig. 2—Made for hardening a cylindrical surface near one end of a long shaft, this horizontal-type induction hardening fixture requires only two electrical connections and two water tube connections to the Tocco hardening machine. A stock of standard aluminum bases, quench rings and quench ring tubes is kept on hand in the hardening room so that the operator of the machine can build up fixtures for any new parts coming through



BY FRANK W. CURTIS, MILLING MACHINE DIVISION, VAN NORMAN MACHINE TOOL COMPANY

Use of suitable fixtures makes induction hardening applicable to a wide range of small parts

HIGH FREQUENCY induction hardening has been applied successfully for several years on such parts as automobile crankshafts and camshafts made in large quantities. Until recently this process has not been available for small-lot runs on a large variety of parts. It has been through the application of specially designed interchangeable fixtures that we have been able to use the Tocco method to advantage with small quantity lots.

The design of these fixtures is such that only two base castings are required, one for horizontal fixtures and the other for vertical fixtures. These base castings are made of aluminum alloy so that the fixtures can be handled easily, reducing set-up time to a minimum. Several standard sizes of bronze quench rings are made up and kept in stock so that fixtures can be assembled for new parts by the operator of the hardening machine.

As shown in Fig. 1 and outlined in Fig. 2, these fixtures consist essentially of the base casting, on which is mounted the quench ring assembly, the copper tube induction coil, fiber connection blocks and brass centering plugs. In Fig. 1 are shown three vertical type fixtures and one of horizontal design. The brass centering plugs are shown in position in the vertical units.

In placing the fixture on the machine it is necessary only to make two connections to the copper induction coil and two hose connections for

Fig. 3—Once the fixture has been mounted on the machine, it is necessary only for the operator to place the part in the fixture, press a starting button and the machine goes through its heating and quenching cycle automatically. Cycles are determined by metallurgical observation of the first piece

quenching water. Fixtures have been interchanged in less than two minutes by our present operator.

Copper tube induction coils are wound to suit the parts to be hardened. Annealed tubing is used and is wound on forms so that it will be of a size to allow approximately $\frac{1}{8}$ in. clearance between the coil and the work. Where flat faces are to be hardened on the end of parts, the coil is wound in the form of a spiral; for hardening cylindrical pieces on the outside diameter the coil is a helix slightly larger in diameter than the part. For beveled gears and other conical parts, the coil is made in the form of a cone. When the necessary coil has been wound, it is tied with asbestos thread and dipped in varnish so that it will hold its shape.

Holes in the quench ring assembly are drilled with a No. 50 drill and are spaced approximately $\frac{1}{4}$ in. apart. Several rows of holes are provided around the quench ring so that the quenching water will cover the heated section of the part quickly. A water pressure of about 60 to 70 lb. per sq. in. is used.

A number of advantages have been obtained by using high frequency induction hardening in place of the case-hardening procedure formerly employed. Previous practice was to use low carbon steel, similar to S.A.E. 2315 or X-1315, with carburizing and hardening operations requiring several hours with two separate heatings of the entire part. This resulted in scale and a certain amount of deformation, with grinding and straightening operations necessary after hardening had been completed. Another saving obtained by using induction hardening is that under the previous method it was necessary to have a man come in on Sunday night to start up the furnaces; this now has been eliminated.

Present practice is to use higher carbon steels, like S.A.E. 2340, 2350, X-1340 or 1050. The 0.40 carbon steels now give a hardness of 55 to 57 Rockwell, while the 0.50 carbon steels are used for higher hardnesses of 60 to 62 Rockwell C. In some cases, with small parts requiring extreme hardness, we have used S.A.E. 52100 steel and have obtained a hardness of 67–68 Rockwell C. The hardened case obtained is uniform and selective. Only certain surfaces need be hardened, depth of case is controlled by the length of the heat cycle and little straightening or grinding after hardening is necessary.

Once the proper heating and

Fig. 4—Once the heating cycle has been completed, water under 70 lb. per sq. in. pressure is admitted through the water tube to the quench ring assembly of the fixture and thence is directed through the induction coil against the heated surfaces of the parts. Both time of delay between heating and quenching cycles and length of quenching cycle are controlled automatically by the machine. Once the fixture for a given part has been made, lots as small as six can be economically hardened by this method

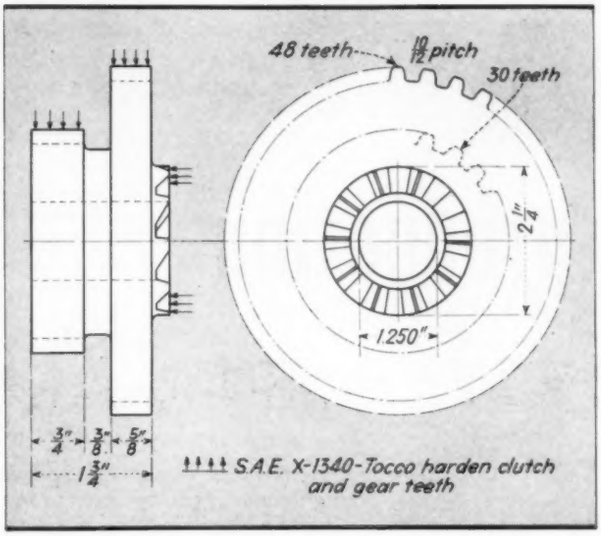
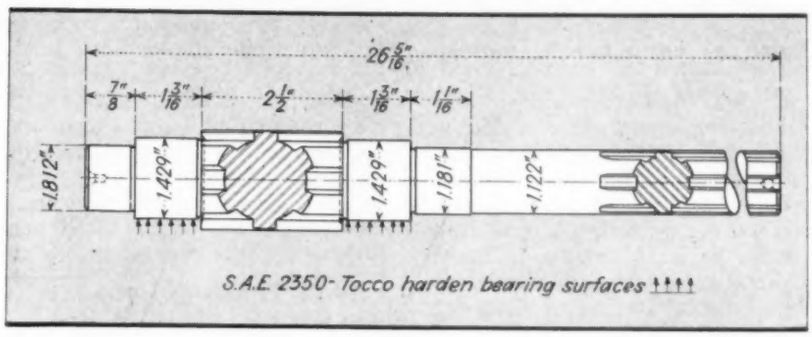


Fig. 5—This combination clutch and gear made from S.A.E. X-1340 steel is induction hardened on three surfaces, using three individual fixtures and hardening one surface at a time. Arrows on the drawing indicate the surfaces to be hardened

Fig. 6—Two bearing surfaces on this 26 in. long shaft made from S.A.E. 2350 steel are induction hardened in a horizontal-type fixture without distortion of the shaft, and without disturbing the hardness of other sections of the shaft. Arrows indicate surfaces hardened

quenching cycles have been determined, uniform results are obtained. We usually set the machine for a $\frac{1}{16}$-in. case on the section of the part to be hardened. The first piece is timed only for bringing it to heat and the time for quenching is estimated. The correct cycle is then recorded and when another piece of the same design is brought to the hardening room the operator consults his record book and adjusts the machine accordingly. The cycle of the machine includes: heating time, delay between heat and quench—seldom necessary, and quenching time. Hardness obtained can be reduced by delaying the quench after the part has been heated.

Because of the inherent reaction of steel as its temperature rises, the heating effect decreases as the critical point of the steel is approached. On this account, the surface being treated cannot be overheated and continued application of power only causes the heat to be generated farther in toward the center of the part.



Job lots as small as from one to six pieces can be hardened economically with this set-up, once the necessary fixture has been made. As many surfaces on the part as necessary may be hardened by providing the necessary fixture for each surface.

Pieces requiring hardening on only one surface usually take about 20 sec. floor to floor time. A clutch part which is hardened on the two faces, as shown in Fig. 4, has been timed at 0.7 min. floor to floor, including the hardening of both surfaces in the same fixture.

In Figs. 5 and 6 are shown two typical parts now being successfully induction hardened without distortion and without additional machining being necessary after the hardening operation. These parts are shown in order to explain the method used to indicate surfaces to be induction hardened. A group of arrows pointing to the surface of the parts indicates the section to be hardened.

Welder Tones Down Locomotive Whistle

By ARTHUR HAVENS

IT IS ODD sometimes just what will bring about a change in locomotives or their appurtenances. In a small city in southern Vermont there is a bad crossing, and it is customary for engineers approaching it to blow their whistles long and loud. The whistles on this road are of the five-step variety having an extremely shrill tone when wide open. This whistling bothered the natives to a point where they made a formal complaint to the railroad management, which didn't want to spend money for new whistles.

A welder figured that if the high step or perhaps the two high steps were cut out or made deeper it would tone the whistle down somewhat. He melted the top from the two high steps, and brazed in pieces of $\frac{1}{8}$-in. plate, continuing the ribs of the whistle to the top. He covered these ribs with pieces of plate bent to the same radius as the body of the whistle, making the originally sharp toned compartments similar to the low-toned parts. This converted the whistle from a five-tone to a three-tone. Since the casting proper is brass the steel plate had to be bronzed to the casting.

This whistle was found to be satisfactory in every respect, being loud enough but not nearly as ear-splitting as before.

METHODS OF MEASUREMENT—No. 4

Fixtures for production

BY C. C. STREET, CHIEF ENGINEER, FEDERAL PRODUCTS CORPORATION

Properly placed dial indicators afford a convenient method of comparing work dimensions to those of an accurate master

THE DIAL INDICATOR finds a wide field of applicatoin where production is on a sufficiently large scale to warrant the construction of special inspection fixtures. Elaborateness and cost of these fixtures depend both on the degree of precision desired and on the complexity of the measuring problem. The art of designing these special-purpose gaging fixtures is sufficiently broad to justify its consideration as a specialized type of engineering.

One of the primary requisites for a proper approach to these special gaging problems is a thorough understanding of the principles of kinematic design, particularly with regard to those principles dealing with restraint. As an example, suppose we wish to locate a flat plate so that it will possess no erratic freedom. It can be seen that if the plate is rested upon three points its position will be established as regards rotation about its longitudinal and lateral axis. This can be seen by referring to Fig. 10, where the plate is supported on points *A*, *B* and *C*.

The next step is to restrain this plate so that it cannot move along its lateral axis. This is accomplished by applying pressure at points *D*, *E* and *F*. With gravity considered as holding the plate against the three points *A*, *B* and *C*, we now have this plate restrained in all degrees of rotational freedom and all but one degree of rectilinear motion. By adding restraint at points *G* and *H*, all degrees of freedom will be restrained and the object will be completely located.

Point of Reference Needed

The importance of this concept is due to the fact that unless extreme care is exercised it is difficult to make surfaces, holes and other components with sufficient accuracy that the position or location of a part will be definitely known. In all forms of measurement it must be borne in mind that for each relationship desired there must be a surface or point of reference. Application of kinematic principles establishes these reference points with assurance. In nearly all instances, a well worked out kinematic design is less expensive to build and retains its precision longer than will other arrangements.

The most common problem encountered in the design of special gaging fixtures is that of determining the size of a round shaft or of a hole, such as a wrist-pin to fit a piston for an automobile engine, or the selection of rolls for a roller bearing. There are two general methods of accomplishing this result. The first is to measure the actual diameter of the shaft by such a set-up as that shown in Fig. 11. Here, we have a lateral rib *A* placed directly under the measuring contact, with a second rib, *B*, used to control the horizontal axis of the work and keep it normal to the spindle of the indicator. Often a second indicator will be placed above strip *B*, so that any difference in diameters will thus be shown immediately.

The shaft may be rolled under the contact point and the maximum reading of the hand will indicate the relationship between the diameter being checked and that of the master with which the gage was set. In some instances it is an advantage to place a backstop, as shown, so that the work can be placed in the fixture easily and care need not be exercised to watch for the maximum reading of the indicator. Wherever a backstop is used, the gage should always be set with a master of the same shape and equal in size to the nom-

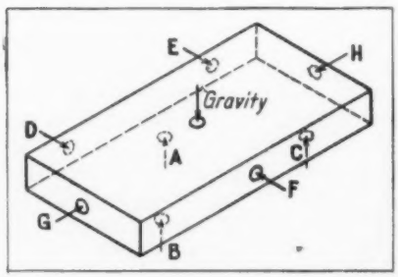


Fig. 10—Restraint at the points shown will locate this plate in definite relation to a given reference point

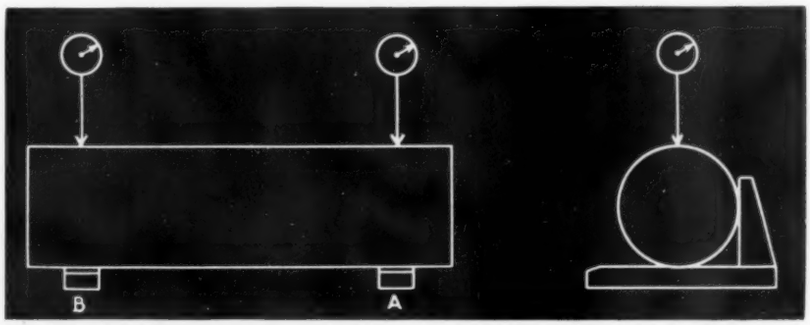


Fig. 11—This set-up will give direct indicator readings of relationship of diameter of the shaft to the master with which the gage was set

inal size of the work being checked. This is because it is difficult to set the backstop so that it will bring the work to a position where the exact diameter will be measured.

If a gage such as that shown in Fig. 11 is set with size blocks and the backstop is located with an error equal to Y, then the false diameter reading D of a piece having a true radius R will equal

$$D = R\left(1 + \sqrt{1 - \left(\frac{Y}{R}\right)^2}\right)$$

This equation will hold good whether the error Y is plus or minus.

The second method of determining the size of a round shaft, now find-

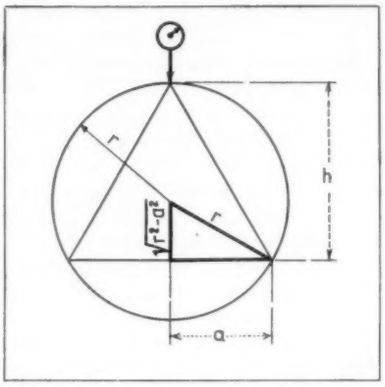


Fig. 12—Determination of diameter by measuring the altitude of an inscribed triangle sometimes gives more accurate results than do direct measurements

ing application in many special cases, is that of determining the altitude h of an inscribed triangle as in Fig. 12. With this method, it can be shown that

$$h = r + \sqrt{r^2 - a^2}$$

Differentiating h with respect to r,

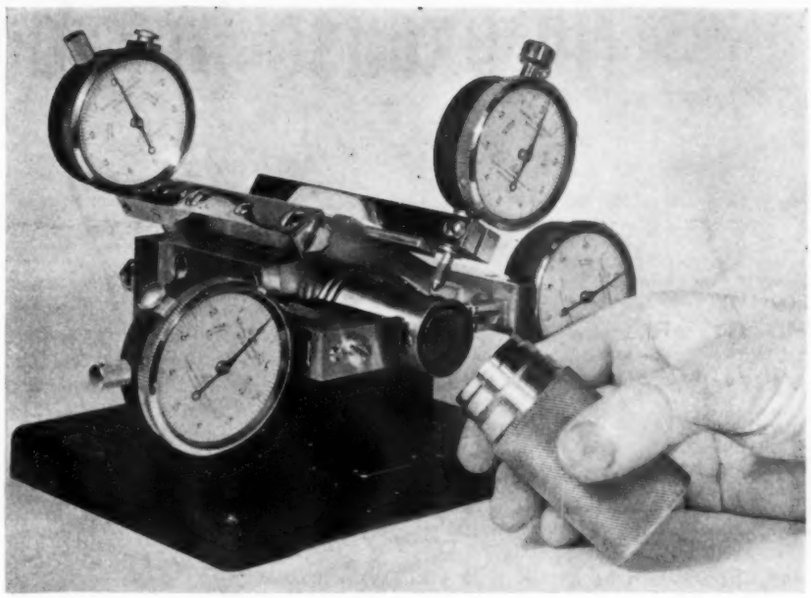
$$\frac{dh}{dr} = 1 + \frac{r}{\sqrt{r^2 - a^2}}$$

From this it can be seen that the indictator will not show directly the change in diameter. If we call $\triangle D$ the change in diameter, then $\triangle H$ (the change in h) will be

$$\triangle H = \tfrac{1}{2}\left(1 + \frac{r}{\sqrt{r^2 - a^2}}\right)D\triangle$$

By proper graduation, the dial of the indicator can be made to read the change in diameter directly.

The particular advantage of this type of measurement comes in the checking of shafts that have been centerless ground. Here the peculiar situation arises in which the shaft will appear truly round when measured with a micrometer caliper, as all readings of the micrometer will be the same. In reality the shaft *may* have the form shown in Fig. 13.



Dial indicators find wide use in the construction of special gaging fixtures. Practically any complex measuring problem can be solved with a properly designed unit like the one shown

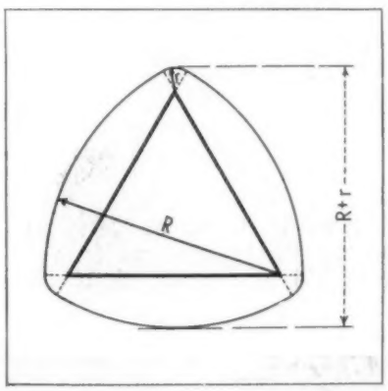


Fig. 13—Shafts ground to this form will seem truly round when measured between parallel planes. A more accurate reading is possible when the shaft is rotated in a V-block

By examining this sketch it can be seen that regardless of how a measurement is taken, if the measuring device consists of two parallel planes the distance between the planes will be $r + R$ at all times. However, if this shaft be placed in a V-block a definite change in reading would be obtained when the shaft is rotated. This type of out-of-round shaft usually is triangular, but it can have any odd number of sides.

The final article in this series by Mr. Street will appear in an early number.

Straightening Magnesium Castings

By ROBERT T. WOOD
American Magnesium Corporation

THE STRAIGHTENING of magnesium sand and permanent mold castings is an operation in which experience and skill are the necessary requisites for success. So far as it can be put down on paper, our practice in straightening magnesium alloy castings is to heat the casting rather quickly to about 430 F., place it under a press with proper support and deflect the casting *slowly* to a point somewhat beyond the point of straightness to allow for spring-back, and then permit the casting to cool to room temperature in the press. The amount of extra deflection to allow for spring-back can only be determined by experience and varies with the type of casting being straightened.

The temper of the casting to be straightened is important. We never try to straighten castings after aging, but always do this work when the castings are either in the "as-cast" or the solution heat-treated condition. Again, after specifying the temperature to which the casting is heated, and the type of equipment to use for straightening, there is little else to say; the success of the operation depends entirely upon the skill of the operator.

No excuse for accidents

BY EDWARD KANN

Every "accident" has a cause. Mishaps with power presses are no exception. Here's the way most can be prevented

THERE IS NO REASON why power press accidents should still happen. If a careful analysis is made of their causes it appears that each is avoidable. In this article is told how in the main stamping department of the Philips Radio Company, Eindhoven, Holland, with 150 presses from 3 to 400 tons, the number of severe accidents yearly was brought down from about five to zero.

Statistics show that practically no accidents happen to die-setters, who generally are skilled mechanics and are supposed to do their work with more care than the less skilled operators. The latter are very often girls, who seldom pay much attention to safety, their only aim being high production resulting in high earnings. Therefore it is good practice not to rely upon the operators' good intentions. In other words, it should not only be made *unnecessary* for the operator to put his hands into the danger zone, but it should be made *impossible*.

Completely inadequate, for instance, are pliers, tweezers and even sliding dies, if used without any other guarding. Many accidents are caused by an operator tripping the press while trying to adjust with his hand a badly positioned blank which was loaded with a pair of tweezers. It is clear that in cases like this the tweezers, pliers or slides did not prevent the accidents because they did not make the access to the danger zone *impossible*.

Operations performed on most presses can be classified in two groups. Group No. 1 are hand operations on strip stock and Group No. 2 are hand operations on blanks or performed parts, so called "second operations." It is not claimed that this classification is complete; but other groups, such as automatic feed, call for guarding methods to be individually developed in every case.

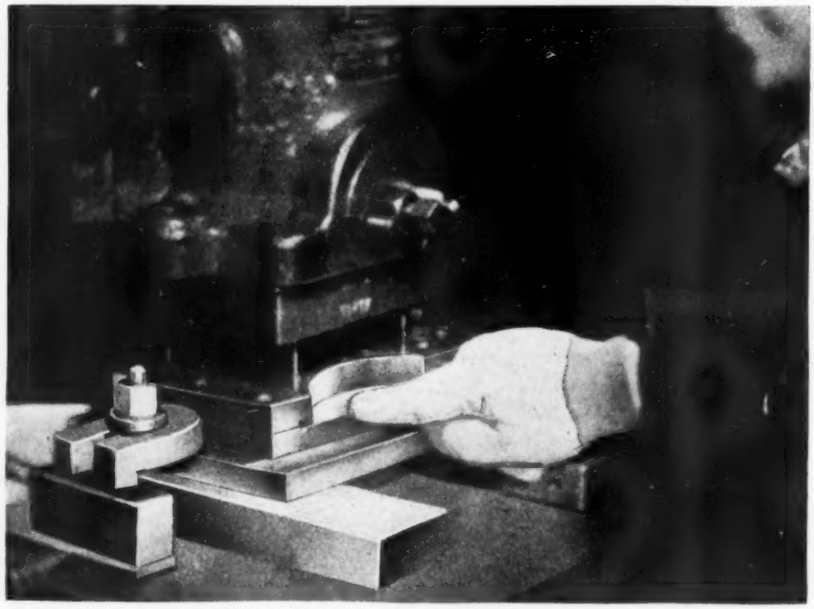
Group No. 1—Feeding strip stock. A fixed guard should be used, preferably one fixed to the tool. A so-called "box tool" is very suitable for the purpose though a tool in a die set can also be fitted with a fixed guard. The press should not have a longer stroke than the operation calls for. The tool should be totally enclosed by the guard and the stock openings should be too small to allow fingers to get in. If necessary compressed air should be used to blow out blanked or formed parts. No opening should be allowed at the front of the tool for removing sticking parts by hand. Wire hooks operating through a small hole should be provided.

Group No. 2—Feeding blanks. This group can be divided in two subgroups:

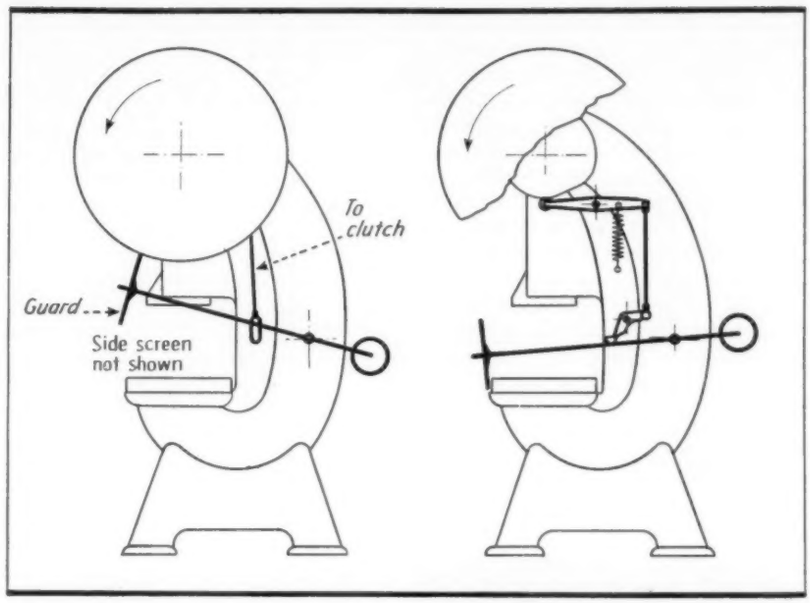
Subgroup No. 2a. Relatively large blanks of which only a part must undergo an operation. An example of this group is the piercing of a hole in the corner of a plate. In these cases it is nearly always possible to have part of the blank extend from the tool. This part is held by the operator and the tool or tool guard is provided with an opening too small to allow fingers to get in.

Subgroup No. 2b. Relatively small blanks which disappear entirely into the tool. This group is the most dangerous of all. In mass production of small parts this is also the most common hand operation and, as a result, the one responsible for the most accidents. Not only do tweezers, pliers, slides, chutes, vacuum feeders, etc., fail to meet the requirements of *impossible access,* but neither do two-handed devices, sweep guards and pull-away guards. These last three are not as objectionable as the others, as their intention is to bar access at the moment of danger. But they are too dependent upon proper adjustment and are very easily subject to abuse. This is not mere theory, as statistics show a considerable number of accidents where these three types have failed.

Sweep guards and pull-away guards are known as "secondary action" guards, as their action starts only after the press ram has been put



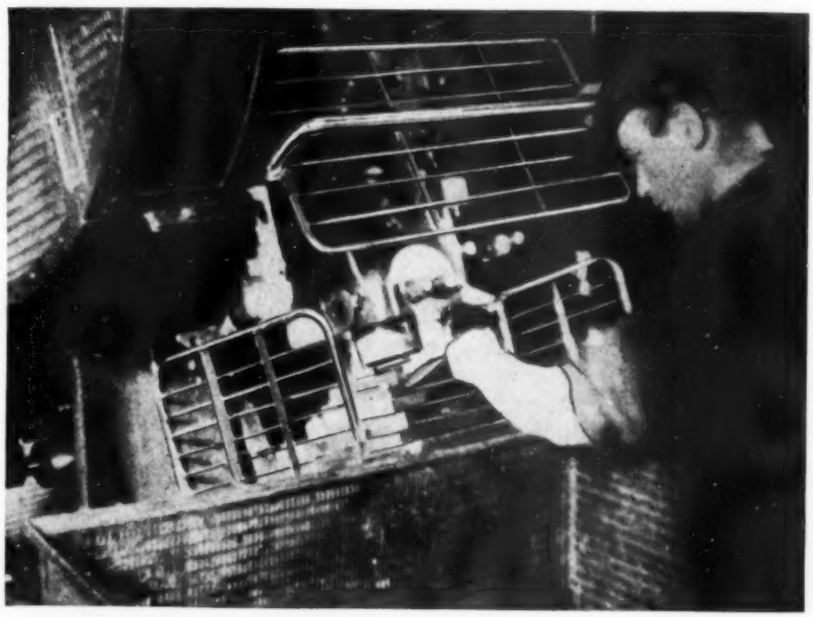
Totally inclosed tools are the safest, as it is physically impossible for the operator to put his fingers in the danger zone. A press stroke only long enough to shear the work must be used



Clutch-actuating guard of the pull-down type keeps the ram from descending until the guard is in position. A lost-motion link at the lower end of the clutch rod permits the clutch to be engaged only at the extreme lower point of guard travel, when it overlaps the bolster plate. A cam-operated latch (right) locks the guard until the upward stroke is nearly finished. Stationary guards, not shown, prevent access to the danger area from both sides

DESPITE THE WAR

While Mr. Kann was on the high seas, his country became a major battleground. The reader's guess as to present safety in Mr. Kann's factory — if it is still there—is as good as ours. However, since the principles discussed are as valid as before the blitzkrieg, no attempt has been made to delete reference to the Holland plant where his methods worked so well.



Greater production, resulting from higher press speeds and increased operator confidence, is achieved with the pull-down type of clutch-actuating guard. Only after the guard is in place is the press tripped

in motion. These guards will never prevent the press from making a stroke.

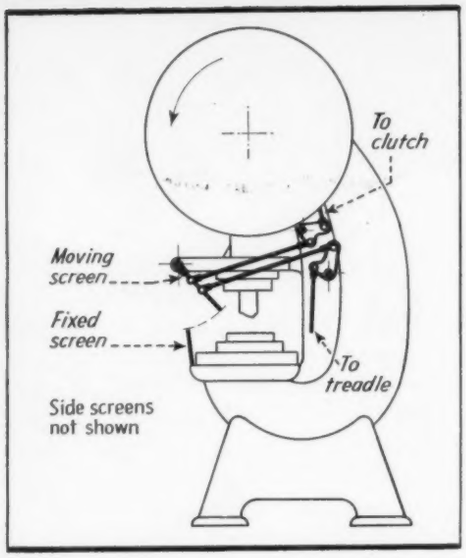
To meet the requirement of impossible access at the moment and in the zone of danger, a guard must be of "primary action." The guard must be fully closed before it is possible to trip the clutch.

There are a few such guards on the market in the United States. Generally they are moved by the treadle and are so interlocked with the clutch mechanism that the latter will not work until the guard is fully closed. Guard movement may be horizontal or vertical. These guards should consist of more than a bar or a sweeping loop. They must have a screen made of wire, perforated metal, or transparent plastic framed in metal to prevent any possible access to the die. Sides should not be forgotten; they may have stationary screens.

A very efficient type of primary action guard is the clutch-actuating guard. When studying the development of primary action guards, logic leads one to this most simple solution: Why not do away with handles and treadles and use the moving screen to actuate the clutch? After inserting a blank in the die the operator pulls the screen down and only after this screen fully shuts off access to the danger zone is the clutch rod pulled down. A simple cam-actuated latch keeps the screen down until the press is safe again.

This type of guard is the safest of all. Even if somebody removes the screen there isn't much left to trip the clutch with. In any case it would be more convenient for the operator to replace the screen. The speed with which such a press can be operated exceeds the speed of a two-handed device, and it does not depend on the size of the tool. This fact is pointed out because sliding dies become very lazy in operation when they involve appreciable masses.

The clutch-actuating guard is part of the press and not of the tool. Its working area should be the entire surface of the press table, so it will take the largest tools. No adjustments are ever required when tools are changed. Thus no fear should exist for accidents caused by maladjustment. All linkages in the mechanism are of



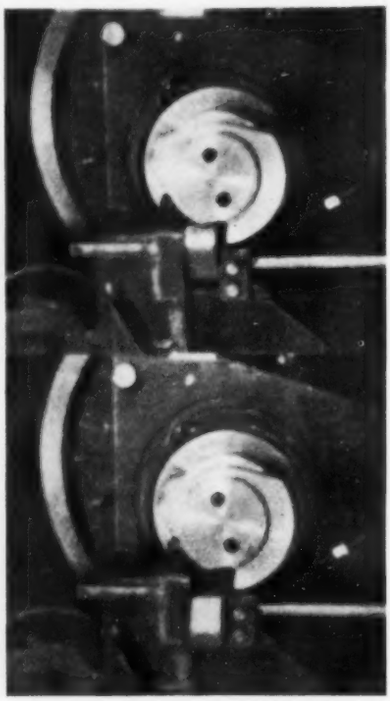
This foot-operated clutch-actuating guard moves easily, as the screen has little mass and there is no counterweight. A cam-operated latch similar to that on the pull-down guard, not shown, is also used with this device

fixed length. Forks should be welded to rods, not threaded.

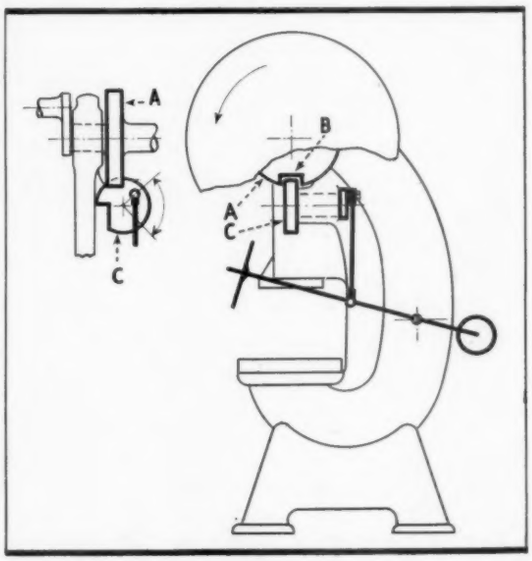
One should be very careful in choosing the correct kind of guarding. If the work belongs to category 2b and one wants something really foolproof, the system just described is recommended. The treadle-operated primary-action guard is less foolproof as it does not prevent the press from being tripped while the screen is removed. In shops where supervision is always sufficient, however, this system may be used with advantage. If correctly designed, it will operate with still higher speed than the hand-operated clutch-actuating guard, as the operator has both hands free. With some guards of this type now on the market, not enough attention has been paid to the ease with which the pedal is moved. If by a few inches of pedal travel a heavy screen must be moved some twelve inches, a counterweight lifted about the same distance and a clutch tripped, it is no wonder that operators complain of heavy working. Also very little attention has been paid to the lessons of motion study. A guard of this type, illustrated, can have small screen travel, no counterweight and still give ample access to the tool. Movement of the screen is in the same direction as that of the hands. Removing the screen disconnects the tripping mechanism.

Primary-action guards cost from about fifty to several hundred dollars according to the size of the press. But in all cases they will pay for themselves. First in bringing down the cost of tools. The guard has to be paid for only once, but the excess cost of tool slides is incurred every time a new tool is made. Second, the increase in speed will bring a profit. There is no doubt about this increase; it is a proven fact that operators increase their speed if they feel absolutely safe. Third, the insurance premium is brought down if efficient guarding is installed.

There remains one point to be considered. That is the danger of repeat strokes. There has been some confusion about the definition of a repeat stroke; in this article any stroke for which the press has not been tripped is called a repeat stroke. So-called anti-repeat devices do not prevent repeat strokes. They should be called single-stroke devices. Repeat strokes are always the result of some clutch defect. Every press builder will claim, of course, that his product cannot repeat, for he has incorporated some marvelous contraption or other, especially designed to prevent the clutch from misbehaving. He does not consider, however, that in spite of all his ingenuity, his customer may forget to oil the clutch or neglect a timely inspection. Minor things such as a weak spring, a sluggishly moving spindle or a damaged key, might cause an unexpected stroke.

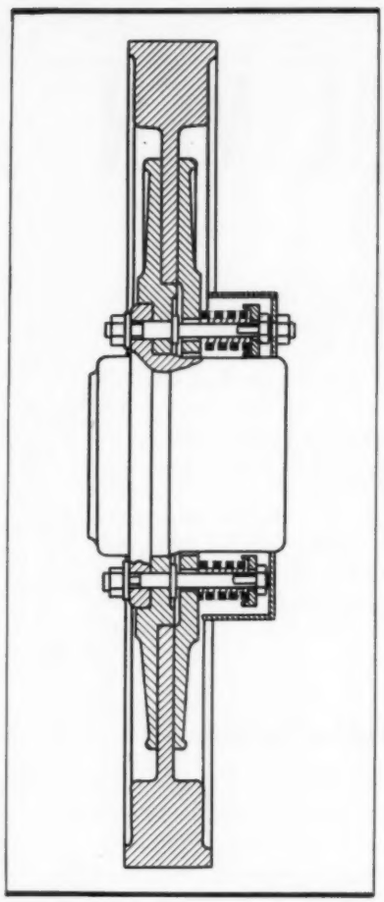


Repeat or unintentional strokes are prevented by locking the crankshaft until the guard is in position. Collar A on solid crankshaft has a notch B engaged by an oscillating stop C controlled by the guard. This mechanism must be rugged, as it absorbs all the energy stored in the flywheel. In presses of over five tons, a friction flywheel must be used to limit the torque to which the locking device is subjected. Above is the stop as installed on a 40-ton press, shown both locked, and unlocked



Repeat Stroke Prevented

The same logic that leads to the clutch-actuating guard will also lead to the solution of the repeat-stroke problem. Suppose something goes wrong in the clutch and it suddenly engages by itself. How can we then hold the ram or the crankshaft? Only by locking it with something that is stronger than the clutch. How this can be accomplished is shown in an accompanying illustration. The crankshaft is locked as long as the guard is not fully closed. It is realized that such a stop mechanism is quite unconventional, but it has proved to be very efficient. If the clutch is engaged while the crankshaft is stopped the belt will slip. Or, in case the press is driven by a small individual motor, the motor will stop. It stands to reason that this device must be of solid construction as it has to withstand an impact of the full accumulated energy of the flywheel. This makes it rather difficult when dealing with presses of more than five tons capacity. The enormous forces involved might easily damage either the stop or the clutch. Therefore on all presses exceeding five tons an overload relief should be incorporated, a very simple one being



Springs of the friction flywheel are adjusted to the correct pressure and the cover sealed to prevent unauthorized persons from giving them an extra turn

a friction flywheel. The spring tension can be adjusted so that no greater torque is exerted on the crankshaft than it is intended to have. Should this maximum be exceeded by the stop-mechanism coming into action, the flywheel will slip. Repeat strokes too are prevented now.

For small and medium size presses in the average mass production press shops, the following guards are recommended (for hand feed only):

1. Feeding strip: fixed guard on tool.
2. Feeding blanks.
   - 2a: Operation on part of blank: fixed guard on tool.
   - 2b: Operation on entire blank: primary-action guard plus crankshaft-stop plus friction flywheel.

The devices described under 2b were developed at the Philips Company's works during the last seven years. All initial troubles have been overcome and a standard construction has been giving full satisfaction for several years. It is realized that only large factories having a number of presses of which many are of the same model, can afford to make such alterations. Others must depend on what the various press builders eventually will do.

Some progressive press manufacturers already have adopted a primary-action guard as standard equipment. But presses are sold in a competitive way and the additional cost of crankshaft stops and friction flywheels seems at present prohibitive, even if made on a production basis. However, the imperfect positive clutches are being superseded more and more by friction clutches. On the larger presses this is already a fact, and there is a trend toward friction clutches on medium-size presses also. As soon as this is achieved the requirements described above are met half way as the addition of an extra friction member will then be superfluous. To complete these presses with a crankshaft-stop is the last step.

Precision Forging

By LUCIEN I. YEOMANS

THIRTY-EIGHT years ago, I made a number of gray iron castings with holes cast within a thousandth of an inch of the desired diameter and in fact made press fits for cold-rolled shafts by casting. It seemed to be a promising practice that would save a great deal of labor.

Six months later it was abandoned as impracticable, not because it could not be done but because in large production the necessary care and attention to detail could not be secured.

The process followed was described on September 4, 1902 (*AM*—page 1263) at the request of Fred J. Miller, then editor, who had seen the work at Antrim, N. H., and had become so enthusiastic over its possibilities that he wrote of it editorially on August 7, 1902 (*AM*—page 1141), as follows:

> In our present issue, among the "Letters from Practical Men," will be found one entitled "Micrometrical Precision in Iron Casting." The letter is quite unpretentious in appearance, except perhaps for its title, which did not originate with the writer of it. We depart a little from our usual practice to commend it to the special consideration of the classes of our readers to whom it should be of interest. To molders it first appeals, indicating a distinct and profitable advance in a detail of foundry practice not yet familiar to the entire trade and probably known to only a very few. The foundry is not the place where we have been in the habit of looking for the minute precision which the title that we have given to the paper would seem to indicate, but the story which the writer tells we believe to be entirely without exaggeration, as we have seen some of the castings of which he speaks. The results accomplished, being as described, they of course speak of opportunities of economy to the machinist and the shop proprietor. They suggest changes in machine shop practice and a different planning and doing of certain lines of work. In agricultural machinery, in textile machinery and various other lines, the amount of drilling and boring involved is a considerable item of the entire work, and the saving of most of this, as suggested by our foundry friend, is really a gift of great value to the machine trade. Of course the process as described carries with it suggestions both as to the limitations of it and as to its possible extension. On account of the shrinkage, holes of large size cannot be cast with the steel core, an inch being here mentioned as a limit, but this suggests the extension of the process to the production of external surfaces with the same precision and finish as is possible with the holes, so that the field of experiment suggested by the letter is a wide one. The letter is also another notable example of the readiness of the American mechanic to tell of his improved methods, or as some might put it, to give away his competitive advantages. Doubtless he will continue to do this thing, and it is our pleasure to help him in it as we have the opportunity, believing that just here is the practice which, more than any other, tends to raise the standard of American machine shop practice.

This is analogous to forge finished cavities in shell. Both can be done on a relatively small scale, under close supervision, at abnormal cost of maintenance, but neither would be successful in mass production.

There are a great many things that enter into it besides the considerations suggested by John Haydock (*AM*—Vol. 84, page 581), and I am afraid he has been "sold" on it ill-advisedly, as Mr. Miller was on my castings on that strangely coincidental August 7, nearly forty years ago.

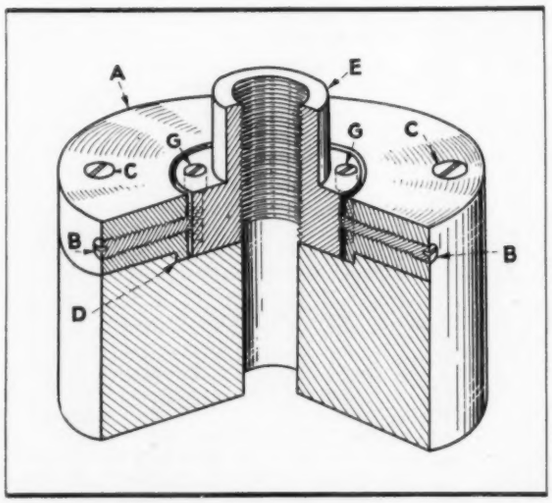
As for me—I have gained a lot of experience in the last 38 years which I did not possess when I was 24 years of age and on my first superintendent's job, and I predict that shell may be made with finish forged cavities up to about 105 mm., but not as well or as cheaply as if the cavity is machined, and above that size it is decidedly impracticable and will not be continued long in emergency mass production.

IDEAS FROM PRACTICAL MEN

Make Universal Chuck Run True

By C. FAUST

The writer has found that the following changes in a three-jaw universal chuck will make it run true. First construct ring *A* of width equal to the length of headless set screws *B*, holes for which are drilled and



When a three-jaw universal chuck fails to run true, the chuck can be mounted on a spindle adaptor on which the chuck can be trued with the aid of screws

tapped in the ring. Remove the screws *C* which hold the chuck together, and drill holes in the ring so that it can be lined up with the screw holes in the chuck. A shoulder *D* is turned on the back of the chuck and on the ring so that the latter will be centralized.

Ring *A* is fastened to the chuck as shown in the drawing. Turn adapter *E* to hold the chuck on the spindle, leaving about $\frac{1}{16}$ in. play adjacent to the ring. Drill holes in the adaptor, $\frac{1}{32}$ in. larger than screws *G*, so that it can be moved. When placing round work in the chuck, indicate and true the chuck by screws *B*. The chuck will run true after screws *G* are tightened.

Auto Transmission Varies Lathe Speed

By FRANK O. HUDSON

Whether or not the automobile type of geared transmission originated in the machine tool field, as some insist, these transmissions have a way of working back into machine drives in various places. The last I've seen is a four-speed Reo transmission salvaged from an old truck that is now doing duty in the shops of the Mobile Pulley & Machine Company.

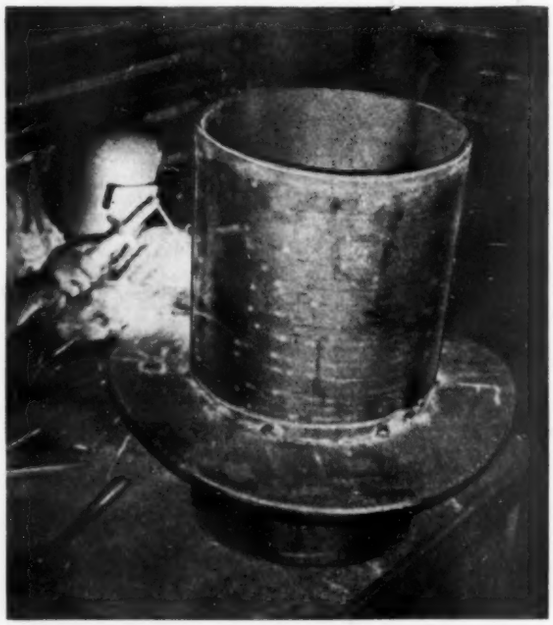
As line shafting was undesirable in their new pattern shop, they mounted the Reo transmission and a variable-speed motor on a casting bolted to the back of a lathe. Then two V-belt pulleys were mounted on both the lathe spindle and transmission shaft, those on the shaft being directly above those on the spindle. The two V-belts from the back end of the transmission therefore give four spindle speeds for each motor speed. Small pattern work is done over the lathe bed. For large work, the back end of the spindle, extended to overhang the bed, is threaded to carry a face plate that revolves in a pit in the floor; this is covered when not in use.

Welded Smoke Stacks Replace Cast Iron

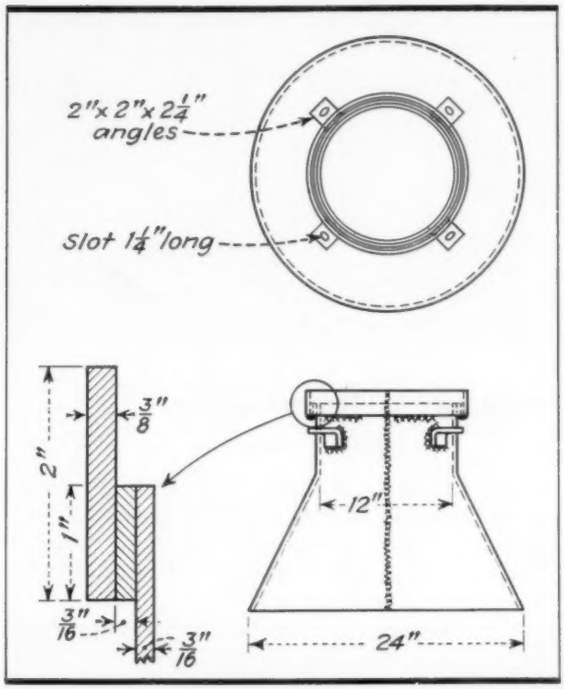
By A. H. CARROLL

Until quite recently it has been the popular opinion that locomotive smoke stacks and petticoat pipes or smoke-stack extensions had to be made of cast iron in order to give satisfactory service. Such stacks are $\frac{3}{4}$ in. thick and often cost $100. But this cost can be reduced materially by making the parts from welded steel plate.

Contrary to general opinion, steel plate does not



Locomotive smoke stacks can be fabricated from welded steel plate, and are as serviceable as those of cast iron. When cinder cut, the steel stacks are easily repaired by welding



This all-welded petticoat pipe is designed to fit the welded stack. Both replaced cast-iron parts at considerable saving in first cost and repair charges

wear away any more rapidly than cast iron. Due to the weldability of such plate, it is a simple matter when the plate becomes cinder cut to remove the worn portion and weld in a new section. Cast iron parts are generally scrapped when worn.

The construction of the steel stack is very simple. A boilermaker and helper, without any special equipment, can cut, roll and prepare the entire assembly for welding in about seven hours. The welding takes even less time. The body of the stack is made from ⅜-in. tank steel and is rolled in one piece with a taper; usually 1 in. in 12 in. The smokebox flange is flame cut to size, its diameter being 10 in. larger than the outside diameter of the stack; the hole in the flange for the stack fit is not cut out until the plate is rolled to the curve of the smokebox. Then the center of flange is removed by flame cutting. The flange is finally located in its proper position on the stack and tacked welded securely. A piece of half-oval 1½ in. steel is rolled to fit the outside diameter of the top of the stack and is tacked in position. Four pieces of 2 x 2 x 2¼-in. angles are welded 90 deg. apart on the periphery of the stack for petticoat attachment. The entire assembly is then welded with coated rod.

The petticoat, shown in the drawing, is a little more difficult to roll due to its abrupt taper. Best results and the greatest accuracy are obtained by using ordinates spaced a couple of inches apart and keeping them parallel with the rolls at all times during rolling. After the skirt is rolled, the top is formed to fit and is tacked to the skirt. There are two pieces of flat iron, one $\frac{3}{16}$ x 1 in. and the other ⅜ x 1 in., needed for the joint at the top of the petticoat.

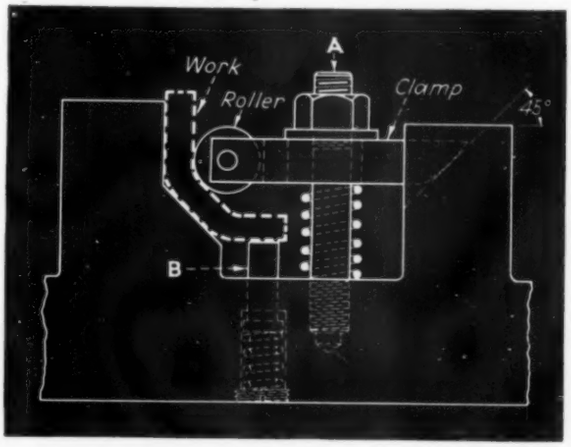
Many front ends are so constructed that it becomes necessary to remove part of the petticoat skirt, especially when space is limited between smokebox plates and the stack. When this occurs, part of the skirt is removed by flame cutting, and a flat plate is substituted, the latter being bolted to the skirt. Four pieces of 2 x 2-in. angle iron, with slots in one flange to take ¾ in. bolts, are welded to the petticoat to hold the flat plate.

Clamps for Holding Work of Odd Shapes

By C. W. HINMAN

The illustration shows a simple and very effective principle for quickly clamping and rigidly holding certain types of odd-shaped pieces in drilling jigs, milling and tapping fixtures, or on a planer bed.

The pieces to be clamped may be a large casting, a rolled section, or sheet-metal work formed in dies. An elongated slot through the clamp and around stud *A* allows the clamp to be moved horizontally when inserting and removing the pieces. When the work is



This roller-type clamp embodies several principles which can be adopted for holding odd-shaped pieces in drilling jigs, milling and tapping fixtures, or on a plainer bed

inserted in the fixture, it is supported by spring-pin *B*, which is depressed when the clamp is tightened.

The use of a coiled compression spring for raising the clamp is optional. This type of clamp and roller holds the pieces securely when the nut is tightened, regardless of variations in shapes and thicknesses of work. The 45-deg. angle and the general design can be varied, of course, to suit other shapes and conditions of work than that shown.

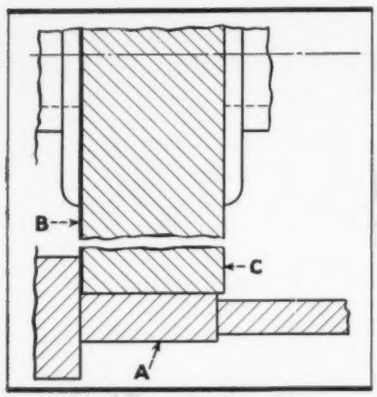
The Solution of a Difficult Grinding Job

By ARMEN TASLYIAN

In grinding a quantity of shafts such as the one shown at *A*, we were forced by circumstances to use a wheel of softer grade than would apply to the aver-

age case. Since the grinding was done by the plunge-cut method and no clearances or grooves were permissible at the interior corners of the shoulders, we had difficulty in grinding them sharp.

However, we solved the problem by cementing the thin shellac-bonded cut-off wheel *B* to the side of the regular wheel *C*, the hole in the cut-off wheel being enlarged to 5 in. so as to clear the clamping collar on



Difficulty in grinding sharp interior corners at the shoulders of shafts was eliminated by using a cut-off wheel cemented to the side of the regular grinding wheel

the wheel spindle. The only matter out of control was that the parts ground by the cut-off wheel were 0.0005 in. oversize, due, of course, to the difference in hardness of the two wheels. But the oversize was soon reduced by holding a small oilstone in the interior corners while the shafts were revolving.

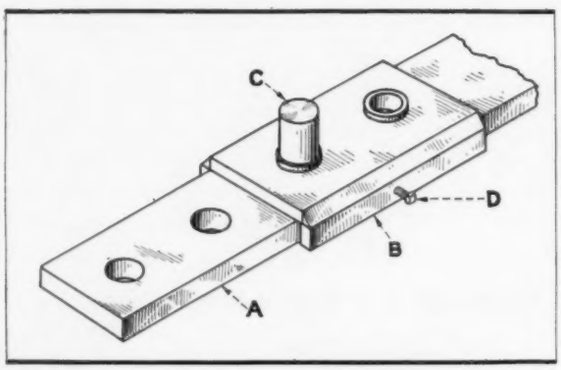
Sliding Drill Jig Spaces Holes

By JOHN E. HYLER

A sliding jig of the general type shown in the illustration may be used for spacing a row of holes in a straight line and at given distances apart. Three pieces of steel are simply welded together as indicated by *B* to fit over the workpiece *A*.

The holes are positioned in such relation in the jig that by holding it flush with the stock at the first end for beginning, and locking the jig on the work with the set screw *D*, the first two holes will be drilled through the bushings in proper relationship with the end of the work. Then the screw *D* is loosened and the jig is moved along until the dowel pin *C*, somewhat pointed and ground to an easy push fit in the holes being drilled, can be inserted in the last of the two holes drilled. Another hole is then drilled through the open bushing. This process is repeated until all the holes have been drilled.

A number of holes and bushings of varying spacings may be provided in the same jig. By using a predetermined sequence of hole selection, required variations of hole spacings may be produced in the work.

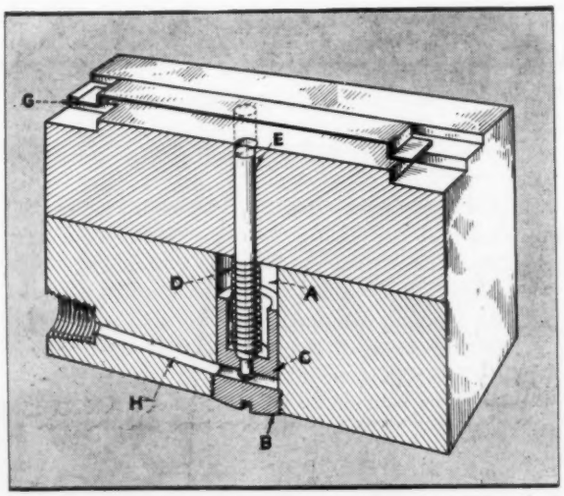


Although this jig is designed for drilling but one hole at a time, its principle can be applied to any predetermined hole selection and spacing

Plunger Aids Air-Operated Ejector

By H. R. HAGEMAN

Upon attempting to eject steel plates from a forming die by means of compressed air after a shallow forming operation it was found that any reasonable volume of air, no matter how applied, would merely lift the plates slightly but would not eject them. The difficulty was overcome in a very simple manner as shown in the drawing.



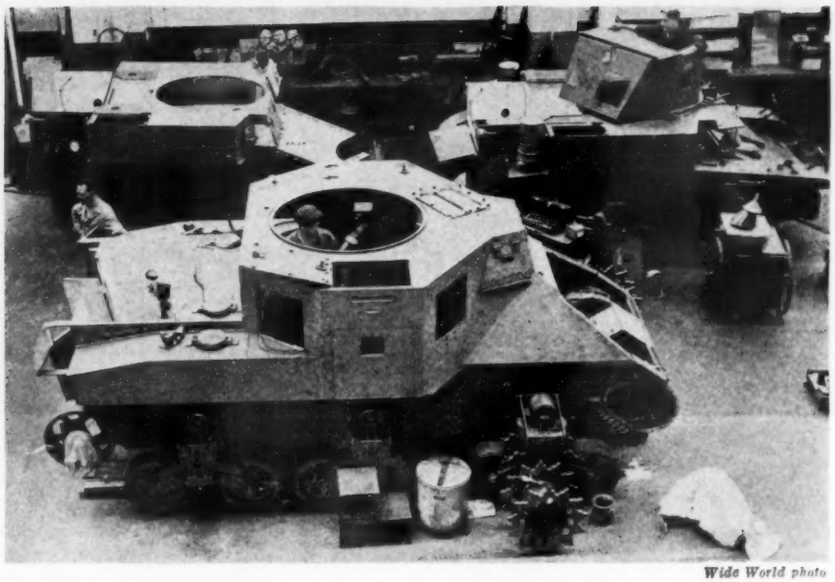
This air-operated plunger with a knockout rod attached was designed to eject steel plates from a forming die when compressed air alone would not do the job

A $\frac{1}{2}$ in. hole *A* was drilled and reamed through the die shoe in direct line with the $\frac{3}{16}$ in. hole already through the die steel. The bottom of the hole was closed with a threaded plug *B* thus forming a cylinder in which a piston *C* of cold-rolled steel was made to slide freely. The piston was bored out from the top to provide space for a very light spring *D* used to insure the return of the piston to the bottom of the cylinder when the air pressure was cut off.

A rod *E* moving freely in the $\frac{3}{16}$ in. hole was mounted in the center of the piston and was of proper length to deliver a positive blow to the bottom of the plate *G* to be ejected, thus knocking it clear of the nest. The air entered the cylinder through a port *H*.

Armament
SECTION OF AMERICAN MACHINIST

TANKS BY THE TON



Wide World photo

TANKS BY THE TON

IN WARFARE, a tank must have speed and maneuverability; it must have a hull tough enough to withstand gunfire and fire power enough to make an effective attack. It isn't easy to turn out a good tank.

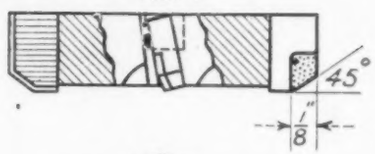
At the present time, the Rock Island Arsenal is assembling an order of 34 combat cars and is underway on an order for 126 medium tanks. The Arsenal has pioneered and experimented on production methods for making these tanks. In the course of this work, it has discovered several "choke" points in manufacturing. Some of these are: machining the cast armor plate, the large diameter ring which forms the track for the turret, the 37-mm. gun mount yoke and the track sprockets, and riveting the hull.

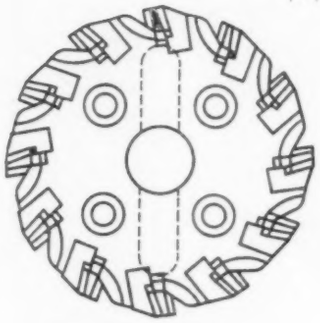
The hull and vulnerable parts of the tank are made tough, or projectile resistant, by using rolled armor plate where sections are flat and cast armor plate where the contours are other than flat. The rolled armor plate is purchased, heat-treated and machined, ready for assembly in the hull. Cast armor plate may or may not be received heat-treated but is machined at the Arsenal.

Machining the armor plate is one of the most difficult operations in tank manufacture. Armor plate is selected according to the ballistic properties which are determined by firing tests made on each heat of castings. The grain structure must be suitable or the material will not have the proper combination of hardness and toughness required to withstand the piercing effect of a 37-mm. shell. Desirable ballistic properties are found in a wide range of hardness, thus making it difficult to establish fixed and definite rules for machining the material.

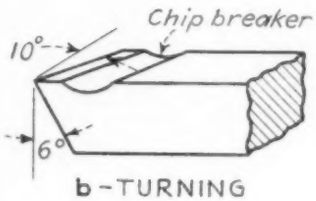
While experiments are underway at the Arsenal on heat-treatment which will give a material of good ballistic properties and good machining properties these have not advanced to the stage

FIG. 1

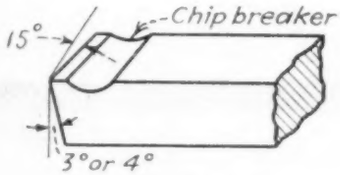




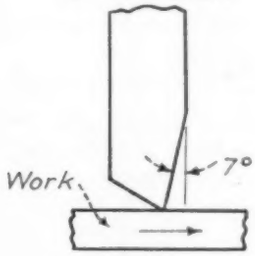
a – MILLING



b – TURNING



c – PLANER



d

where the machining procedure can be made absolutely uniform. However, for the present, certain general rules for machining armor plate do apply. All cutting must be done at low speeds, much slower than for alloy steels. It is better to run slow with a heavy cut. The cutter must be kept moving right through the material and not permitted to slow up. For example, a milling cutter must be running before starting into the work and must move into the work continuously and slowly. If it is permitted to idle or to take very shallow cuts the material will glaze over, become almost impossible to cut, and the tool will dull rapidly.

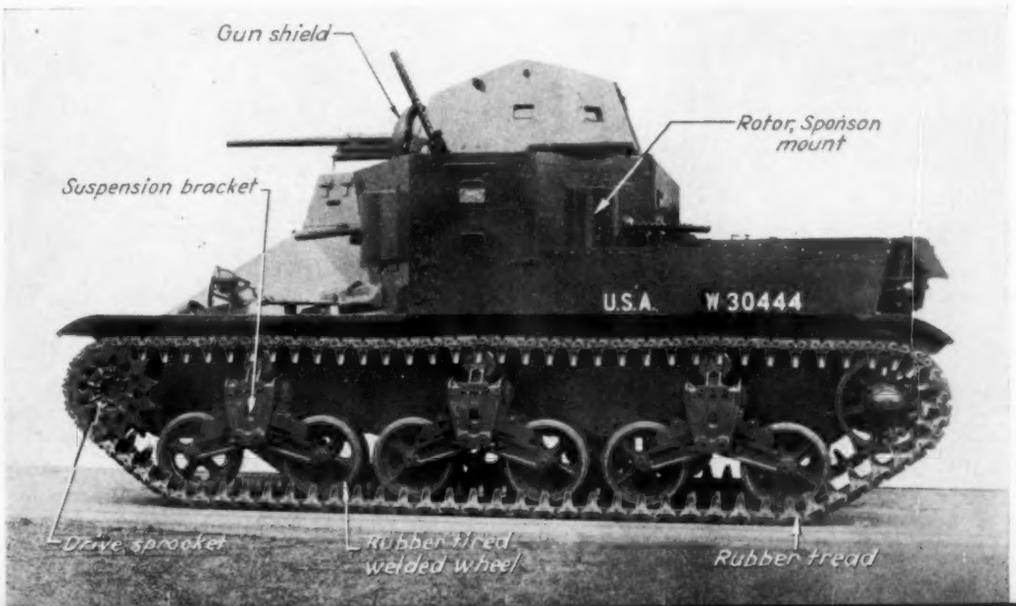
High-speed cutting tools such as Apex, Rex AA, Illinite, Columbia CC have been used. Stellite 2400 has been applied successfully. A cobalt-molybdenum-tungsten (8-8-1½) alloy has been used for drills and reamers.

Milling cutters should not have a rounded edge. They have been found to operate best with a 45 deg. angle at the tip as shown in Fig. 1*a*. Turning and planing tools ground as shown in Fig. 1*b* and *c* have been found satisfactory. Another method of grinding tools to get a shear cut in planing or shaping is shown in Fig. 1*d*. With the tip of the tool higher than the point it has been found that there is less heating of the tool with consequent longer life and with less power consumption.

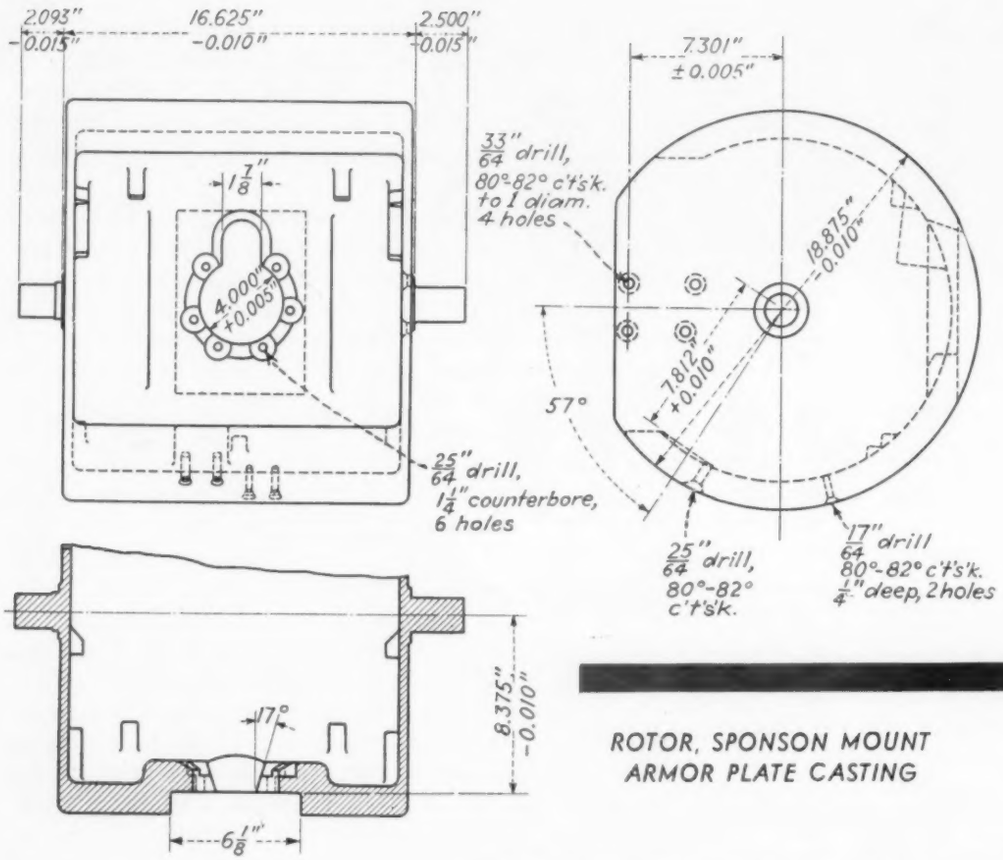
The difficulty in machining the internal parts of the tank is not one of cutting materials but rather that of handling the thin and sometimes complicated sections as typified by the 37-mm. gun mount, the turret ring and the track suspension brackets. Procedures for these will be outlined below.

One noteworthy point in machining these castings is that all of them are worked on general purpose tools. In many cases this work has to be done by mechanics of different grades of ability. Jig and fixture design, therefore, is important; most jigs must be made substantial enough to be ready for production runs of any desired amount. Many of them incorporate set blocks so that the machine operator need use only feeler gages, 0.01 in. in thickness to set his tools at the proper height or position. Targeting fixtures are used on all jigs for castings to equalize the material around the bearings and other cut-outs.

The choke point on the drive sprockets has been pretty well solved by cutting them four at a time on a Kellermatic. Both roughing and finishing cuts are taken in the same machine using two templets.

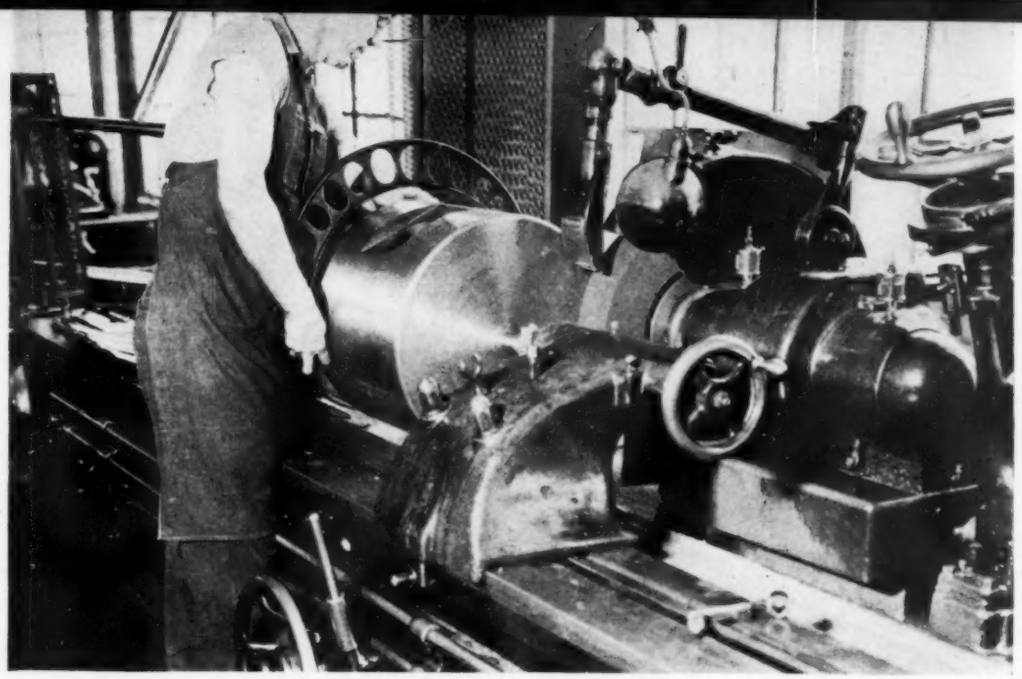


Cast Armor Plate Parts



ROTOR, SPONSON MOUNT ARMOR PLATE CASTING

The sponson mount rotor, heat-treated cast armor plate, is first mounted in a lathe where the ends are faced and the outer diameter and trunnions are turned. 0.025 in. of stock is left for a finish grinding operation. High-speed steel cutting tools are used with slow speeds, and soluble cutting oil is applied both to the tools and to the lathe centers



The trunnions and outer diameter of the rotor are finish ground using a 4-in. 46 grain 24-in. wheel running at about 760 r.p.m. with a slow cross feed while the work revolves at about 200 r.p.m. A soluble oil is used in this grinding operation. After grinding the rectangular slot which can be seen in the illustration is milled and the hole is bored to a tolerance of plus 0.005 in.

Operation Sheet for: ROTOR, SPONSON MOUNT

MATERIAL: Steel Casting, Homogeneous Armor Plate, heat-treated.

1. Snag grind inside of casting. *Note: Entire interior must be free from all roughness and sharp edges.*

   INSPECT

2. Layout trunnions for centers.

   INSPECT

3. Center drill trunnions.

   INSPECT

4. Place on centers and rough turn one trunnion for chucking.

5. Chuck the rough turned trunnion and rough turn trunnion on opposite end. Face opposite end allowing 3/32 in. stock all over for finish. Turn radius.

6. Rough face opposite end, rough turn trunnion on opposite end and rough turn outside diameter, allowing 3/32 in. stock all over for finish. Turn radius.

   INSPECT

7. Finish turn outside diameter, leaving 0.025 in. stock for finish grind. Finish turn trunnion allowing 0.025 in. stock for finish grind and finish face end. Finish turn trunnion on opposite end allowing 0.025 in. stock for finish grind and finish face end.

   INSPECT

8. Finish grind the 18.875–0.010 in. diameter.

   INSPECT

9. Finish grind trunnions.

   INSPECT

10. Drill three 33/64 in. diameter holes and drill and ream one 33/64 in. diameter hole. *Note: The hole to be reamed is the upper left hand hole in upper right hand view on drawing.*

11. Countersink four 33/64 in. diameter holes.

    INSPECT

12. Mill the 6⅛ in. slot, bore the 4.000 + 0.005 in. diameter hole and rough out the 1⅞ in. angular slot with straight cutter.

    INSPECT

13. Finish mill the 1⅞ in. x 17° angular slot.

14. Finish mill the 57° angular pad to the 7.812–0.010 in. dimension.

    INSPECT

15. Finish mill the ⅜ in. radius along flat side.

    INSPECT

16. Mill off center lugs from trunnions.

17. Remove burrs and sharp edges.

    INSPECT

18. Drill six 33/64 in. diameter holes in side of rotor.

19. C'bore six 33/64 in. diameter holes on inside of rotor 1¼ in. diam.

20. Drill and c'sink two 25/64 in. diameter holes and drill and c'sink two 19/64 in. diameter holes.

21. Remove burrs and sharp edges.

    INSPECT

22. Assemble spring in rotor.

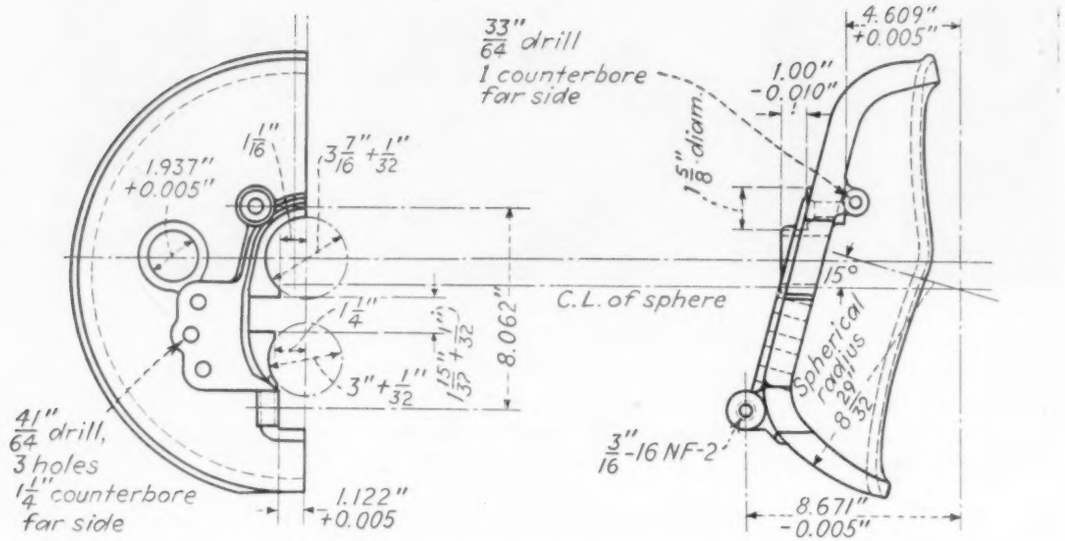
23. Grind pads to fit ammunition box.

    INSPECT

24. Paint entire rotor except two trunnions one coat of primer and paint interior with an additional coat of white enamel.

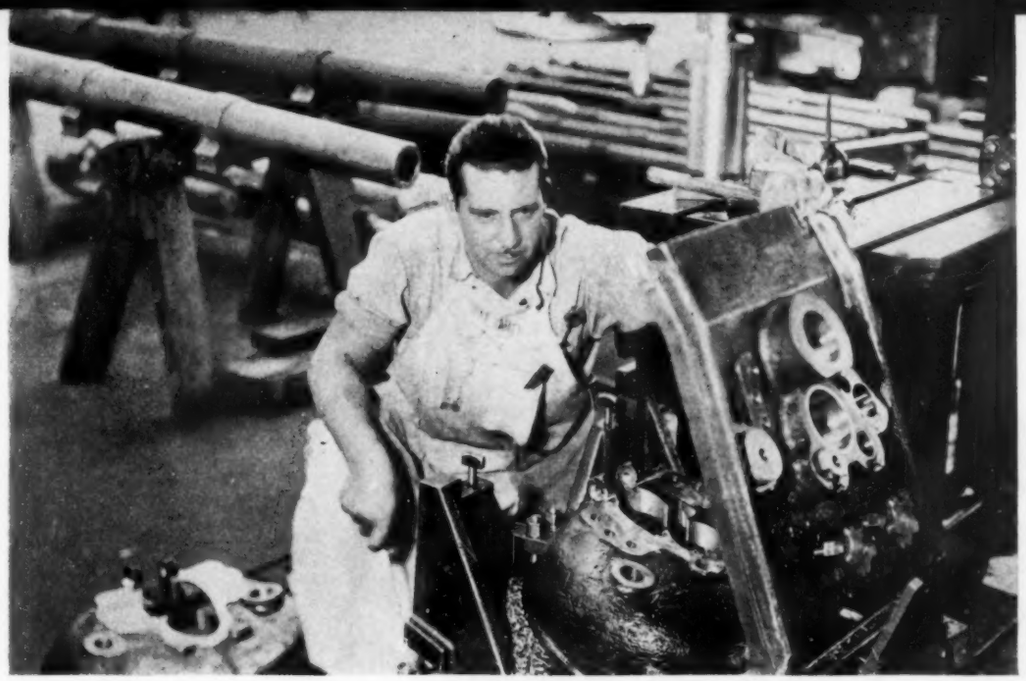
25. Slush trunnions to prevent rust.

Cast Armor Plate Parts



SHIELD, RIGHT, ARMOR PLATE CASTING

Gun mount shields are cast in two halves with three lugs which are used for positioning in the fixture and are later milled off in the final machining operation. The sequence of operation on these shields is as follows: 1. Disk grind the joint face of castings; 2. Mill the bottom of the three locating pads; 3. Mill the joint face to 0.001 in. tolerance. After this the shields are worked in pairs beginning with the milling operation shown here. A 15-deg. angular pad is being milled on the outside face of the right and left shield at one time. A stop is built into the fixture for the cutter which is the only way of measuring the proper depth. Inserted high-speed steel blade cutter is turning about 14 r.p.m. with $\frac{5}{8}$ in. feed. Sulphur base oil is used. It has been found important in milling cast armor to grind the outer corner of the cutters at 45 deg. as shown in Fig. 1. This has been found to give better cutting and longer tool life



The gun mount shields are drilled and bored in pairs in a radial drill using the hinged-top fixture shown here. High-speed steel or cobalt drills and reamers are used for these operations which consist of boring a $3\frac{7}{16}$ in. diameter hole, a 3 in. diameter hole, drilling a $\frac{41}{64}$ in. diameter hole, a $\frac{5}{8}$ in. diameter hole and taper reaming a 30 deg. angular hole, and drilling three $\frac{41}{64}$ in. holes. The fixture is arranged so that it can be tilted to permit drilling the angular hole. Feeds and speeds must be very slow. Feed must be continuous for if the cut is allowed to stop the tool will dull immediately. Sketch at the left gives general details of the part

Operation Sheet For: SHIELD, RIGHT

MATERIAL: Steel Casting, Homogeneous Armor Plate, heat-treated.

NOTE: Shield, Left, manufactured in conjunction with this shield starting at Operation 6.

1. Disk grind the joint face of castings.

2. Mill the bottoms of three locating pads. Mill the sides of two pads. Mill the 4.609 + 0.005 in. dimension of the 1⅛ in. boss on inside of casting. *Note: These dimensions are taken from cutter set gages on fixture.*

   INSPECT

3. Mill the joint face. Mill the 1 1/16, the 1¼, the 1 15/32 slot, and the 1.122 + 0.005 in. dimensions.

   INSPECT

4. Mill the relief notches in locating lugs on joint surface.

5. Remove burrs and sharp edges. *Note: Starting with the following operation, work in conjunction with shield, left, which has similar preliminary operations.*

   INSPECT

6. Mill the 15° angular pad on outside face. *Note: Shields to be machined at one time in fixture.*

7. Bore the 3 7/16 in. diameter hole. Bore the 3 in. diameter hole. Drill the 41/64 in. diameter hole. Drill and ream the 1.937 + 0.005 in. diam. hole and drill three 41/64 in. diam. holes in pad.

8. Drill the 33/64 in. diameter hole and tap drill one ¾-16NF-2 tapped hole. Spotface the 33/64 in. diameter hole and tap ¾-16NF-2.

9. C'bore the 1⅛ in. diameter and c'sink the 41/64 in. diameter hole. Spotface the 1.000 — 0.010 in. dim. of the 1.937 + 0.005 in. diameter hole. Spotface three 41/64 in. dia. holes on inside of casting.

   INSPECT

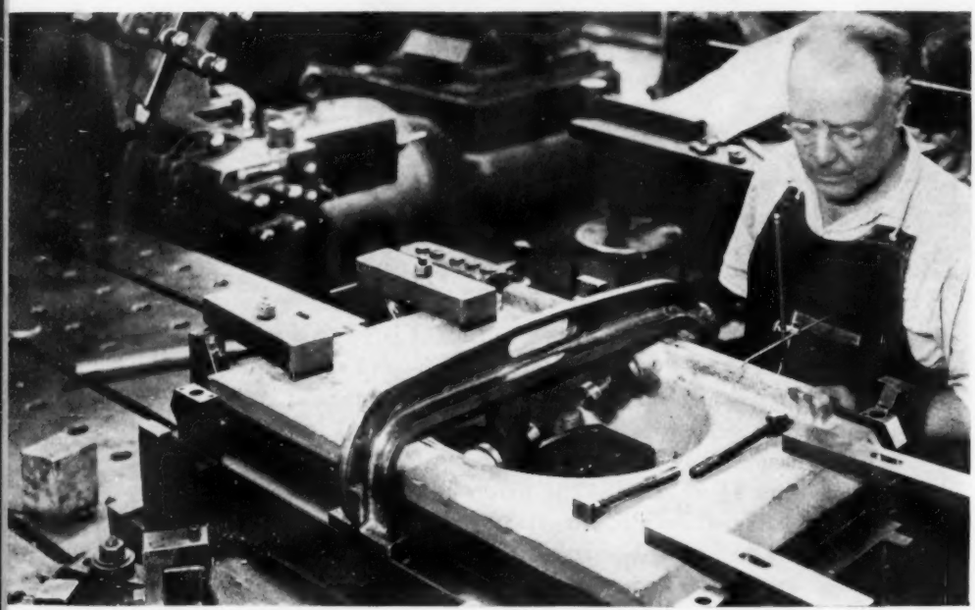
10. Mill off three locating lugs.

11. Remove burrs and sharp edges.

    INSPECT

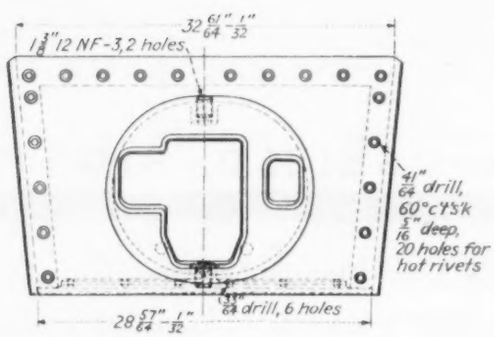
12. Paint one coat of primer.

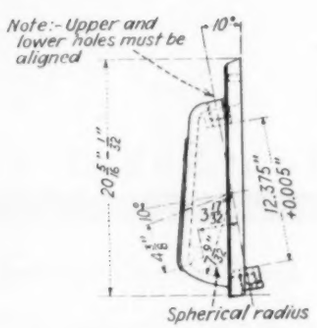
Cast Armor Plate Parts



The turret front plate casting is being set up here for the first operation of planing the four sides. An index fixture is used and a targeting arrangement centers the casting prior to clamping. Set blocks at the corners of the casting simplify setting the cutting tools. Apex type tools have been found satisfactory in these planing and cutting operations. A very slow feed and about $\frac{1}{8}$-in. cut has been found satisfactory. Tools are ground with very little rake or clearance. Holes for mounting the 37 mm. gun are drilled later at a horizontal boring machine

PLATE ARMOR
PLATE CASTING

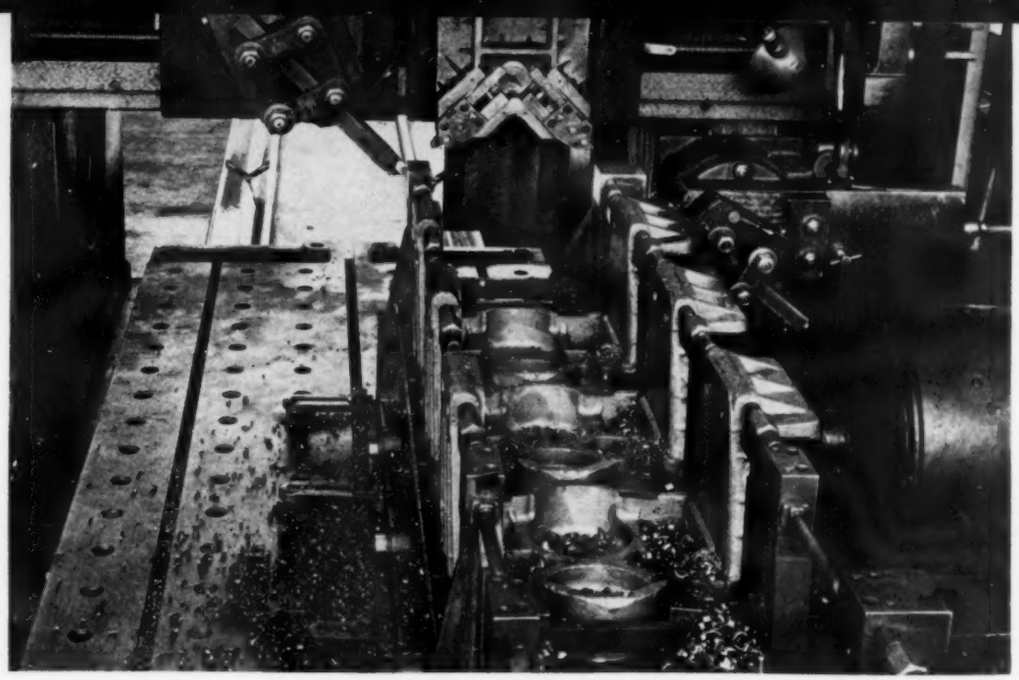




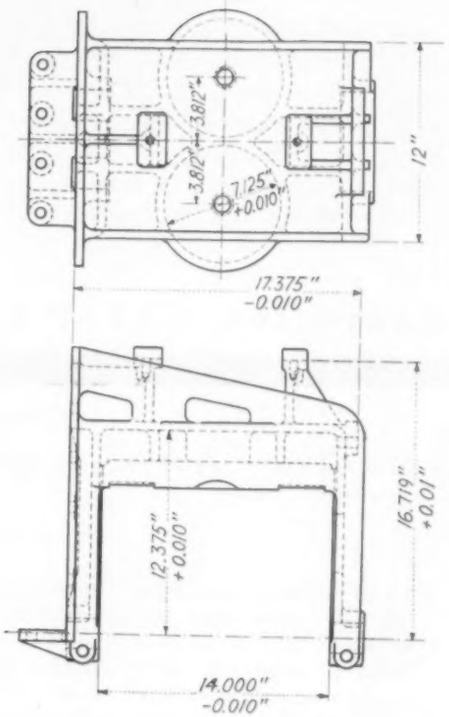
Operation Sheet for: PLATE, FRONT, TURRET

MATERIAL: Steel Castings, Homogeneous Armor Plate.

1. Solution heat-treatment.
   INSPECT & WEIGH
2. Sandblast to remove all scale.
   INSPECT & WEIGH
3. Reheat to critical temperature for 2½ hrs. Critical thickness ¾ in. Cool in freely moving air.
4. Sandblast.
   INSPECT
5. Plane the four sides of plate complete.
   INSPECT
6. Drill, bore, ream, tap the backface the 1⅜-12-NF-3 holes.
   INSPECT
7. Mill the 3 17/32 in. dim. bosses.
8. Mill the 10° angular pad to the 4⅜ in. dim.
   INSPECT
9. Drill the twenty 41/64 in. holes.
10. Drill the six 33/64 in. holes.
11. Drill the two holes for ¼-2ONC-3 tap.
12. Tap the two ¼-2ONC-3 holes.
13. Countersink the twenty 41/64 in. holes as shown.
14. Remove all burrs and sharp edges.
    INSPECT
15. Paint one coat of primer.

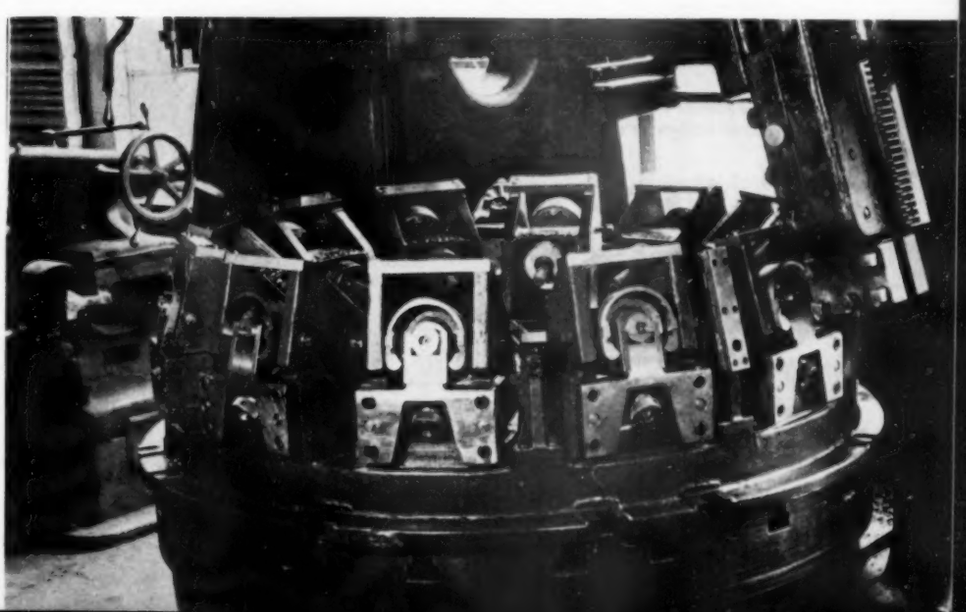


Miscellaneous operations on steel castings are shown in the accompanying two photographs. Above is shown the arrangement for planing the inner and outer surfaces of the track suspension bracket which has a hardness of 33-38 scleroscope. Six are set up at one time on the planer table. They are held rigidly in position by hinged arms which swing up between the castings. The ends of these arms are in the form of a yoke in which are two screws which can be extended by the hexagon nuts which are visible in the illustration. The position of the tools is determined by set blocks on the fixture. Note the special clapper type fixture used for the two center cutting tools

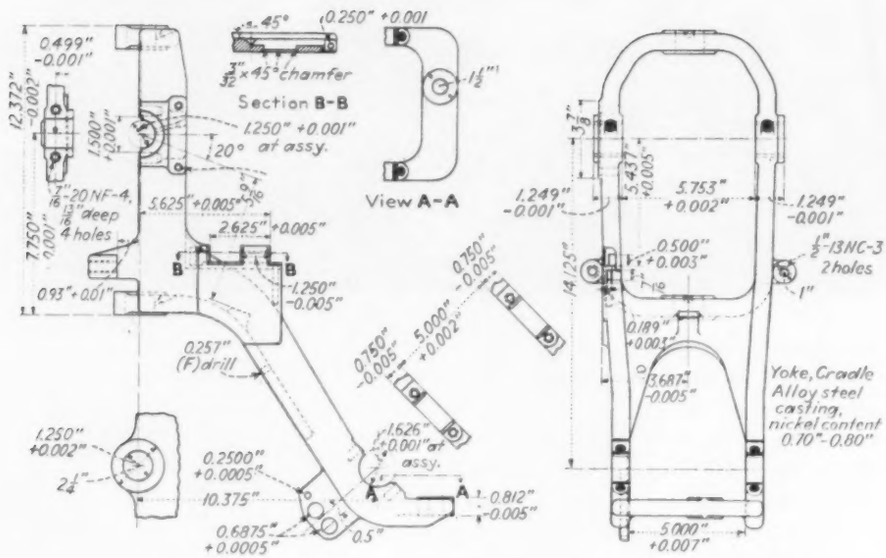


Cast Alloy Steel Parts

At the right is shown the set-up for turning the conical face and key on the roller bearing housing which supports the turret. The fixtures are arranged on the table of a vertical boring mill so that the cutting tool generates the necessary angle to allow the roller carried by the housing to mate with the raceway on the turret ring shown on page 722. The set blocks for the key and for the face can be seen at the center and right. Three pairs of these brackets support the turret. They must be mounted on a true circle so that the turret will turn easily



Cast Alloy Steel Parts



Operation Sheet for: YOKE, CRADLE

MATERIAL: Alloy steel casting, heat-treated.

1. Paint one coat of primer and paint numbers 1 to 475 inclusive on castings.

2. Straighten.

3. Finish mill three locating pads. *Note: Rough mill the trunnion cap bearing faces and the 1.500 + 0.001 in. key seat of bearing cap leaving 1/32 in. stock for finish on these surfaces. Rough mill the 2¼ in. diam. bosses of pinion bearings on the inside faces leaving 1/16 in. stock for finish. Finish mill the three locating pads on the 1 in. diam. bosses.*

4. Remove burrs and sharp edges.

INSPECT

5. Spot and scrape the three locating pads on the 2¼ in. dim.

INSPECT

6. Rough mill the outside of two trunnion bosses and two pinion bosses leaving 1/16 in. stock for finish.

INSPECT

7. Rough straddle mill the inside faces of trunnion bosses leaving 1/16 in. stock for finish on all surfaces.

INSPECT

8. Rough mill the two notches on left hand side of yoke leaving 1/16 in. stock for finish on all surfaces.

INSPECT

9. Mill the 45° angular clearance for slotter cutter, using a 5/16 in. dia. end mill in Ecklund head.

INSPECT

10. Rough slot the 0.500 + 0.003 keyway, leaving 1/16 in. stock.

11. Remove burrs and sharp edges.

INSPECT

12. Re-spot and re-scrape the three locating pads if necessary.

INSPECT

13. Finish mill the trunnion bearing cap faces and the 1.500 + 0.001 in. keyways, and finish mill the inside faces of the 2¼ in. dia. boss of pinion bearings.

INSPECT

14. Finish mill the inside faces of trunnion bosses to the 5.753 + 0.002 in. dimension. Use standard 8 in. diam. cutters 1¼ in. wide by 1½ in. bore alternate angle.

INSPECT

15. Remove burrs.

INSPECT

16. Finish mill the two outside trunnion faces to 1.249 — 0.001 in. Finish mill the two outside pinion faces to the 7.750 — 0.001 in. from center of trunnion bores and the 12.372 — 0.002 in. over all dimensions. Finish mill the ¾ x 3⅜ in. pad on left hand side to the 0.499 — 0.001 in. dimension shown in cut view in upper left hand corner of drg. Finish mill the ammunition tray pad to the 3.687 — 0.005 in. dimension and the top of the two 1 in. diam. bosses to the 0.930 + 0.01 dimension. Use Standard 24 in. rotary table.

INSPECT

17. Finish mill the two notches in ammunition tray pad to the 5.437 + 0.005 in. and the 5.625 + 0.005 in. dimensions from center of trunnion bores and the 1.250 — 0.005 and the 2.625 + 0.005 in. dimensions.

18. Finish slot the 0.500 + 0.003 keyway.

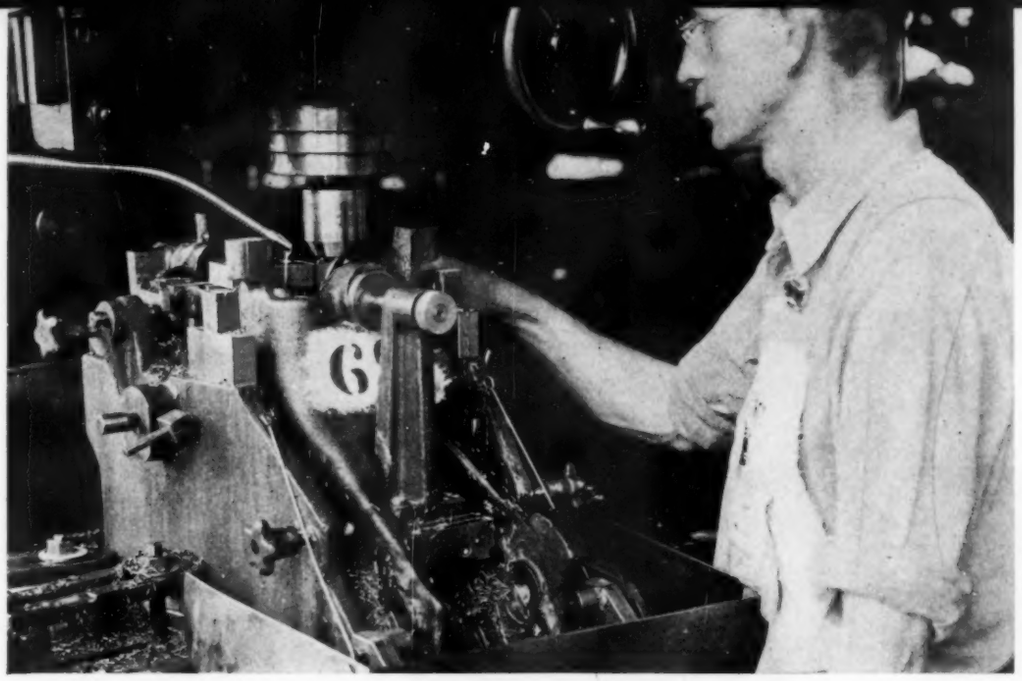
19. Remove burrs and sharp edges.

INSPECT

20. Rough and finish straddle mill the 1½ in. bosses to the 0.812 — 0.005 in. thickness. Use Standard 8 in. dia. alternate angle cutters.

21. Remove burrs.

INSPECT



One of the more extensively jigged parts on this tank is the 37-mm. gun mount yoke which is a heat-treated alloy steel casting with Brinnel hardness of 235-260. Since this part is of rather complicated structure and has a comparatively thin cross-section for purposes of weight saving, special care must be exercised in the machining operations. The casting is first set up in the fixture shown here. Three locating pads are finish milled after the casting has been properly centered by means of the targets. Care in performing this operation will avoid difficulties in the succeeding machining operations. All castings that do not target are returned for restraightening

22. Rough and finish straddle mill the trunnion faces to the 5.000 + 0.002 and 0.750 — 0.005 in. dimensions at the 1.626 + 0.001 dia. cross bore. Use Standard 8 in. dia. alternate angle cutters.

INSPECT

23. Rough and finish mill the trunnion bearing cap faces and the 1.875 + 0.001 in. keyway of the 1.626 + 0.001 in. dia. cross bore.

INSPECT

24. Rough and finish mill the face of pad projecting below the 1.626 + 0.001 in. to the 5.000 + 0.007 in. dim. shown at bottom of right hand view. Use Standard 8 in. dia. cutter.

INSPECT

25. Mill the 20° angular stop pad to the 5 9/16 in. dim.

26. Remove all burrs and sharp edges and file the 3/32 x 45° chamfer in notches.

INSPECT

27. Tap, drill four 7/16-2ONF-4 tap holes. Tap drill two ½-13NC-3 holes.

28. Tap drill four ⅜-24NF-4 tap holes.

29. Drill and ream the 0.250 + 0.001 dia. hole.

30. Drill two No. 12 dia. holes in end of the 0.189 + 0.003 × 7/16 in. slot.

31. Tap four 7/16-NF-4 tapped holes and tap two ½-13NC-3 tapped holes.

32. Tap four ⅜-24NF-4 tapped holes. *Note: The No. 4 fit of tapped holes must be held for studs.*

INSPECT

33. Finish mill the 0.189 + 0.003 × 7/16 in. slot.

34. Remove all burrs and sharp edges. Use hand reamer in the 0.250 + 0.001 in. dia. hole.

INSPECT

35. Assemble studs and caps.

INSPECT

36. Drill and ream the 1.250 + 0.001 in. trunnion diameters, the 1.250 + 0.002 in. pinion diameters and the 1.626 + 0.001 in. trunnion diameters. Tap drill two 5/16-24NF-2 holes. Drill and ream the 0.250 + 0.005, one 0.687 + 0.0005 dia. hole and drill one ⅝ in. dia. hole.

INSPECT

37. Disassemble caps and nuts for finish machining and remove burrs from yoke and cap bores.

38. Drill, ream and spotface four oil holes in trunnion bearings. Drill the 0.257 (F) dia. hole.

39. Tap two 5/16-24NF-2 tapped holes in ¾ x 3⅜ in. pad on left hand side of yoke.

40. Spotface both sides of the 0.257 (F) dia. hole.

INSPECT

41. Mill off the temporary locating pad from the 1 in. diam. boss on left hand side.

42. Mill off the temporary locating foot.

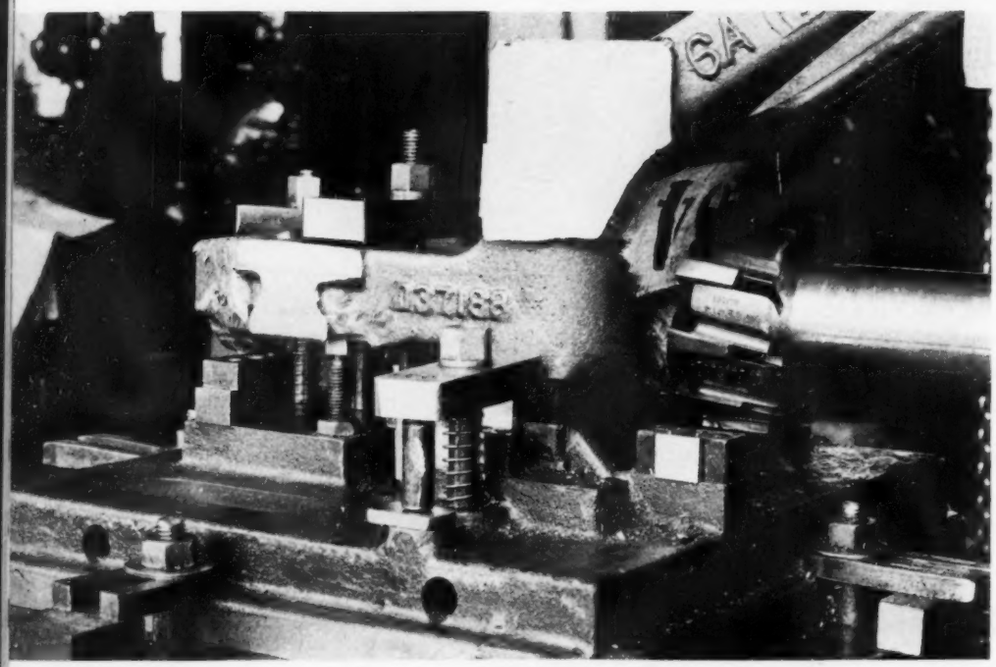
INSPECT

43. Reassemble caps to proper markings on yoke.

44. Hand form radii in the 1.250 + 0.001 dia. bore. Hand form radii in the 1.626 + 0.001 dia. bores.

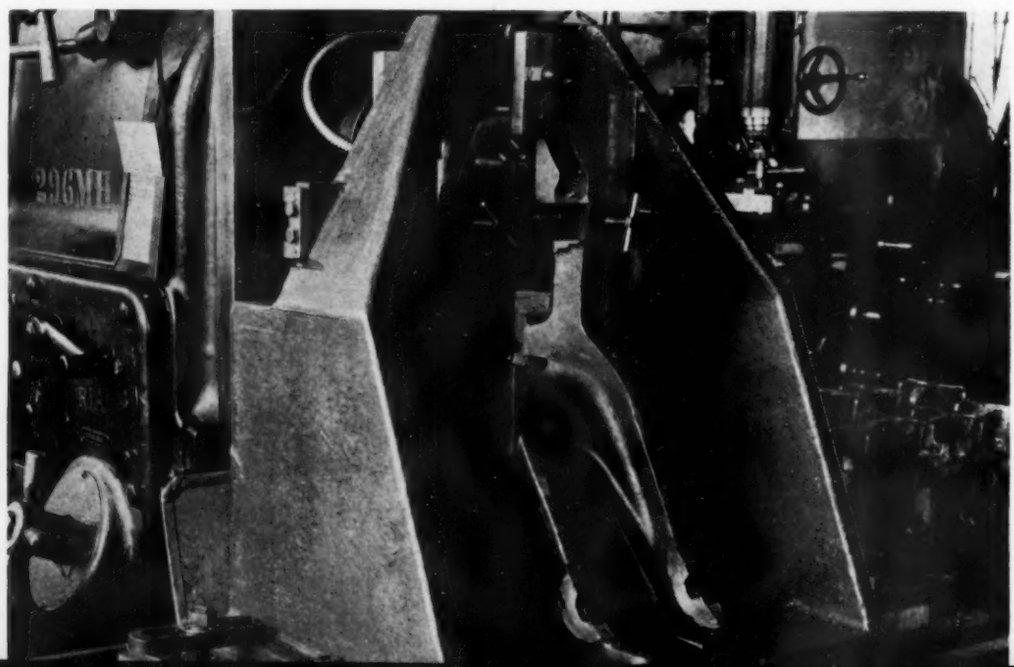
45. Remove burrs and sharp edges. File smooth where locating lugs were milled off.

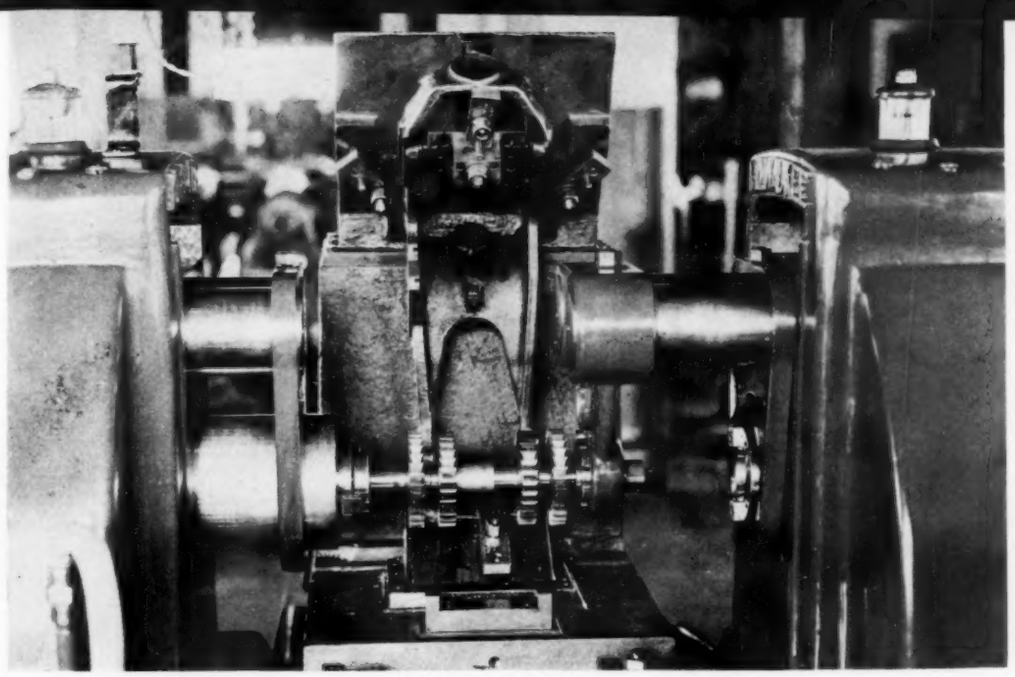
Cast Alloy Steel Parts



The part is then moved to a horizontal milling machine and mounted on the locating pads in the fixture shown here. The outside surfaces are rough milled at this point using standard milling cutters

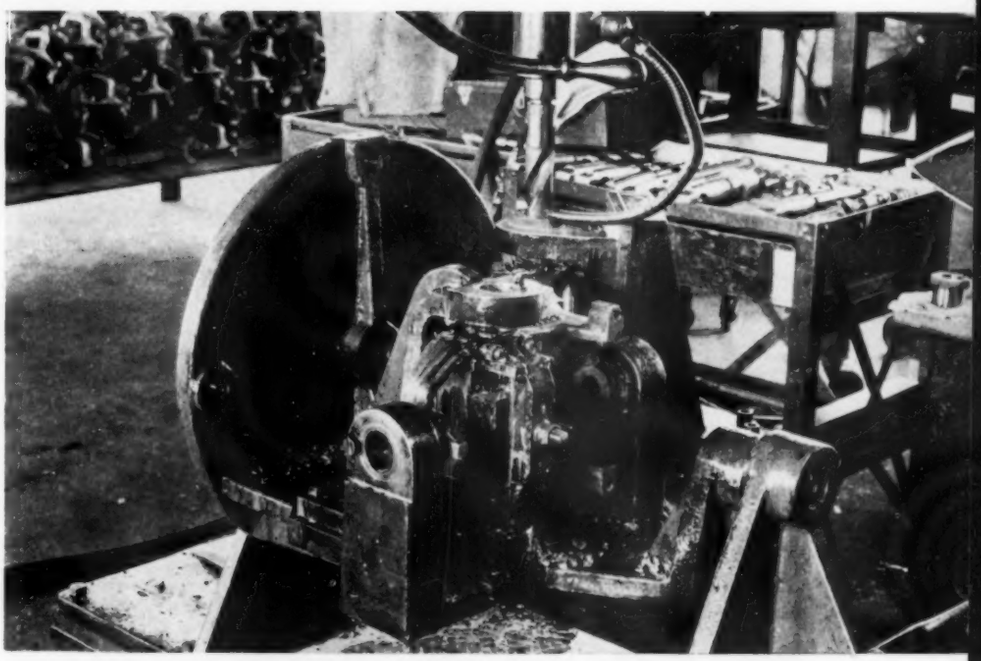
Internal faces are milled on another horizontal milling machine in the fixture shown here. Note the set block at the left hand side of the fixture; the operator sets cutter using 0.01 in. feeler gage

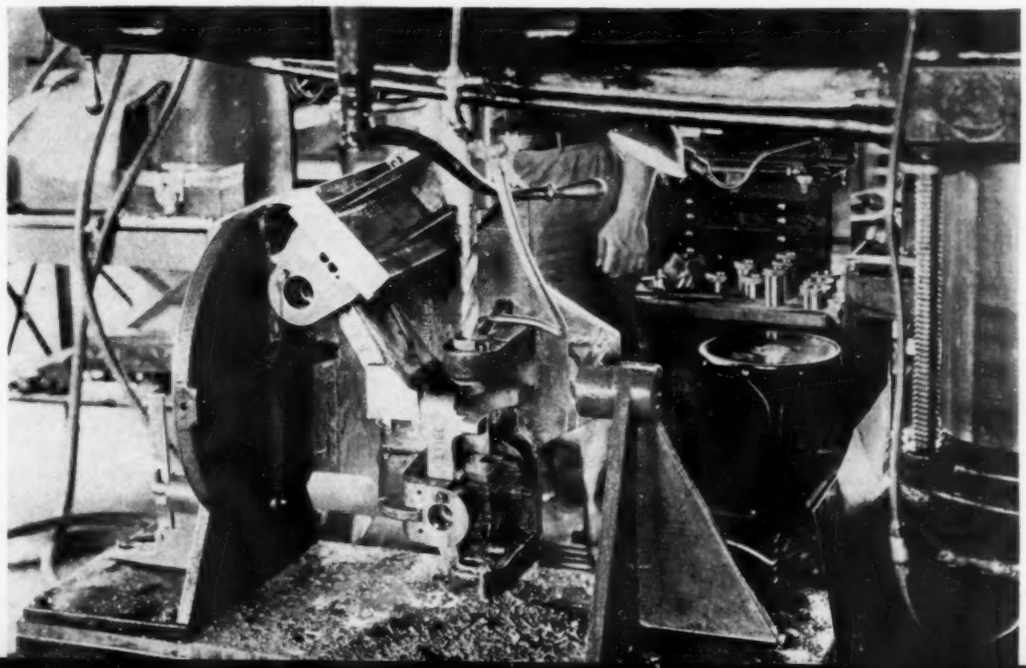




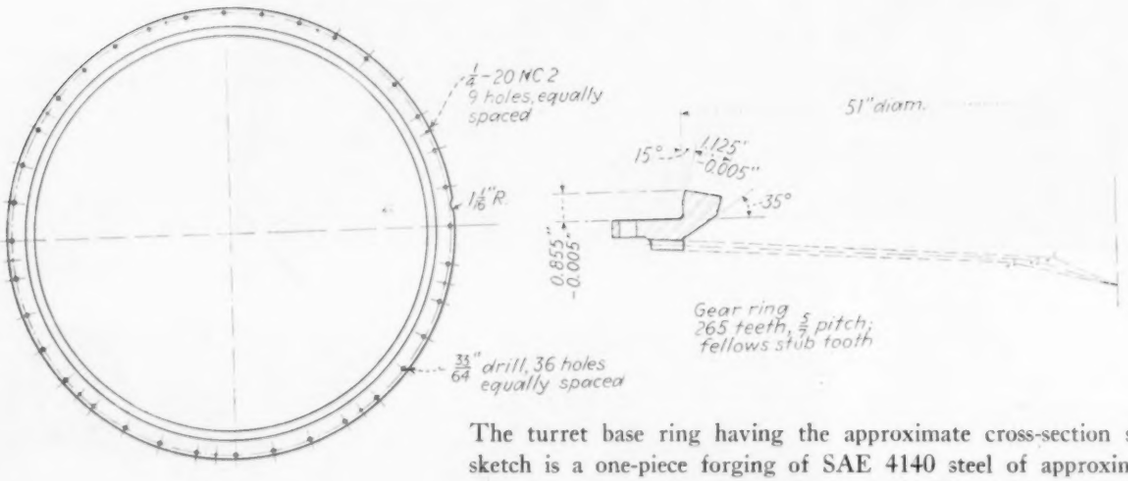
Trunnion bearings are straddle milled in a duplex milling machine while being supported at the proper angle in the jig so that a straight-in feed can be used without having any projections interfere with the high-speed steel cutters

Final drilling and reaming operations are performed in a radial drill using the rotating jig in two positions as shown in the two accompanying illustrations. Soluble cutting oil is used for the drilling operations and sulphur-base oils for the tapping operations. High-speed steel drills and reamers are used. The trunnion bearing face on the casting is wider than the bearing cap. The ledge thus formed on the inside of the yoke casting serves as a locating pad and insures that holes will be reamed and drilled exactly on the parting line center. The temporary locating pads and feet are milled off as the final operation

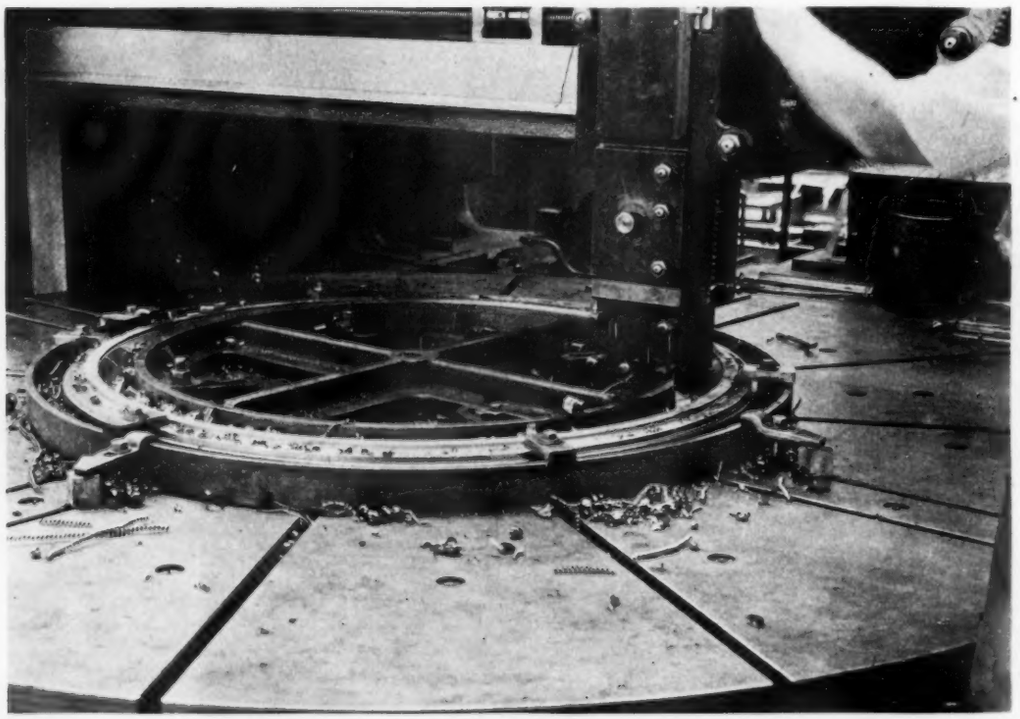


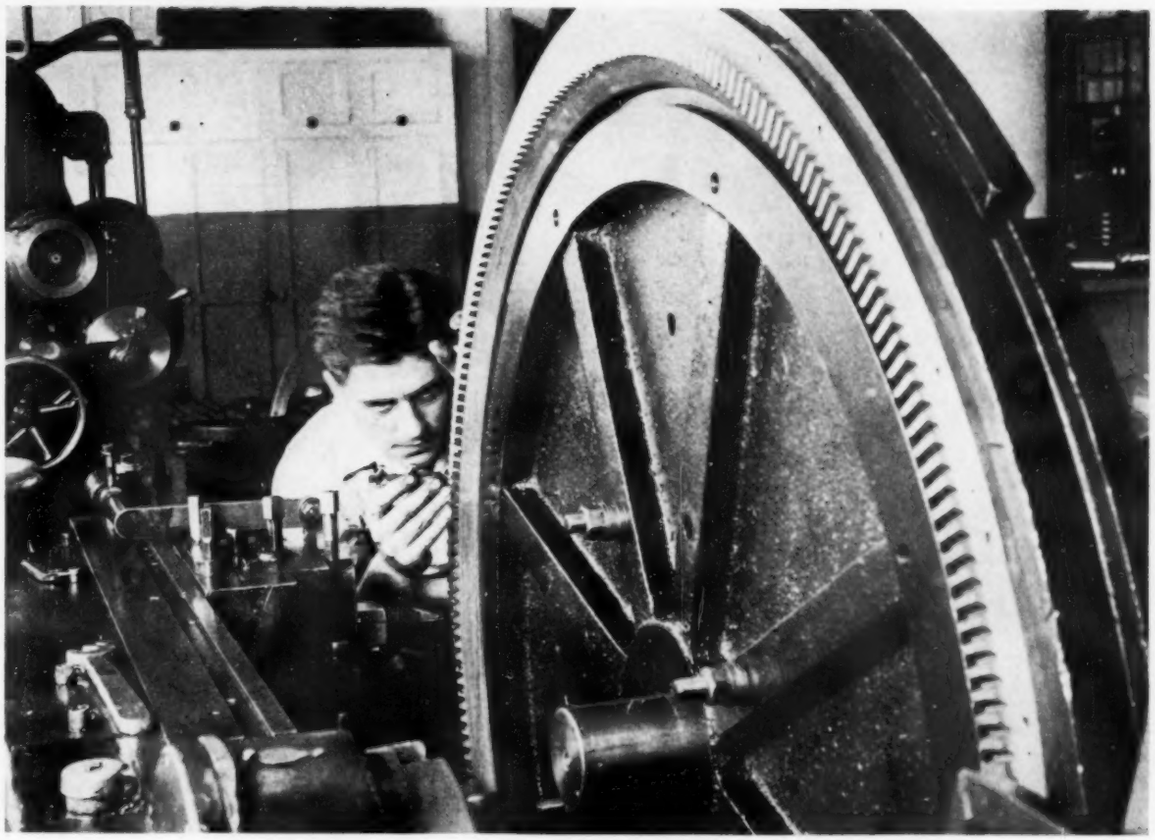


Chromium-Molybdenum Steel



The turret base ring having the approximate cross-section shown in sketch is a one-piece forging of SAE 4140 steel of approximately 51 in. diameter having a Brinnel hardness of 255 to 295. It is first rough turned and faced on top side and gear side in a Gisholt machine and then finish turned as shown here in a Cincinnati Hydromill. Feed downward is 0.010 in., table speed is 1.57 r.p.m. Rex XX tools are used for heavy cuts, high-speed molybdenum cutting tools for light finish cuts. The ring which is of comparatively thin section is clamped in the heavy cast fixture. General tolerances on this ring are minus 0.005 in. After holes have been drilled and tapped in the ring it is ready for the final operation of cutting the teeth





Teeth on the gear ring are cut in a bevel gear generator using four high-speed tools, a narrow one for the first plunge cut, a wider one for a second plunge cut, a finishing tool for the bottom of the tooth, a finishing tool for the top of the tooth. This Fellows stub tooth gear has 265 teeth, 53 in. pitch diameter, 1 in. face, and is made to a tolerance of 0.005 in. backlash

Operation Sheet for: GEAR RING

MATERIAL: Rings forged without welds, chrome-molybdenum steel, normalized, annealed, heat-treated to Brinell hardness 255-285.

1. Rough turn and face top side.
2. Rough turn, bore and face gear side.
3. Finish turn the diameter holding it to 51.000–0.005 in. and the 0.855 in. face. Turn the 15° face of roller pad. *Note: The 51.000–0.005 diameter is for fixture purpose.*
4. Finish turn and face gear side. Finish turn the 35° face and the 1.125–0.005.

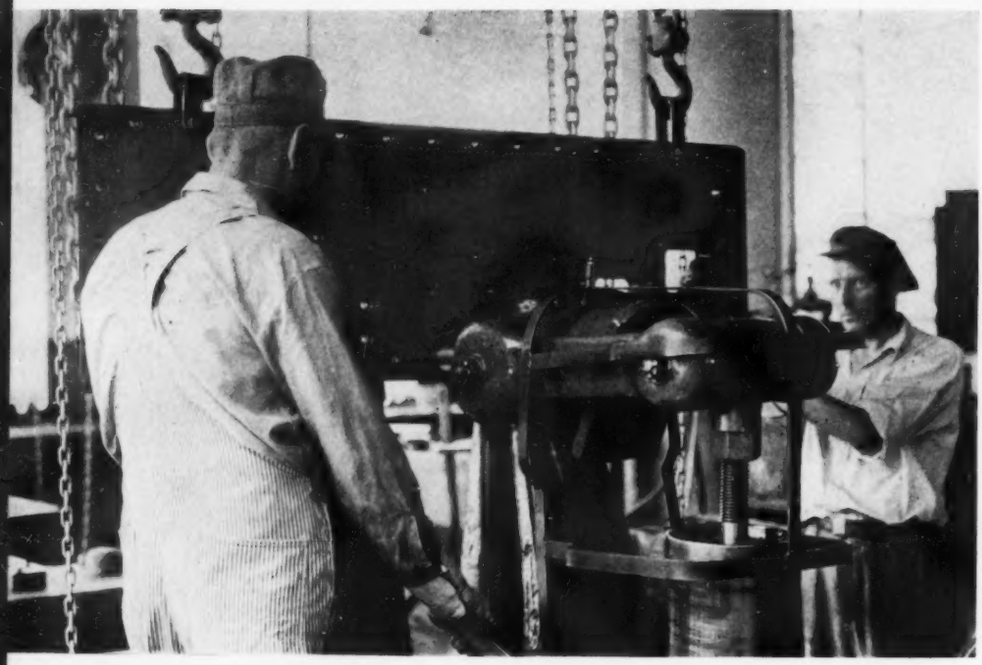
   INSPECT
5. Drill all holes for ⅜-16-NC-2 tap and the nine ¼-2ONC-2 holes.
6. Tap every other ⅜-16-NC-2 hole and tap all the ¼-2ONC-2 holes.
7. Remove burrs.

   INSPECT
8. Mill the 1 1/16 radius 5/16-in. deep and remove burrs.

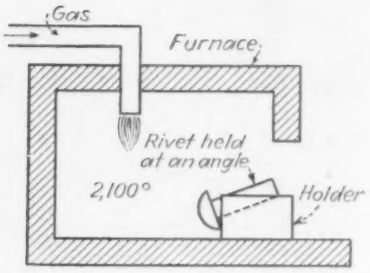
   INSPECT
9. Cut teeth.
10. Remove sharp edges from teeth.

    INSPECT
11. Grease to prevent rust.

Tank Assembly

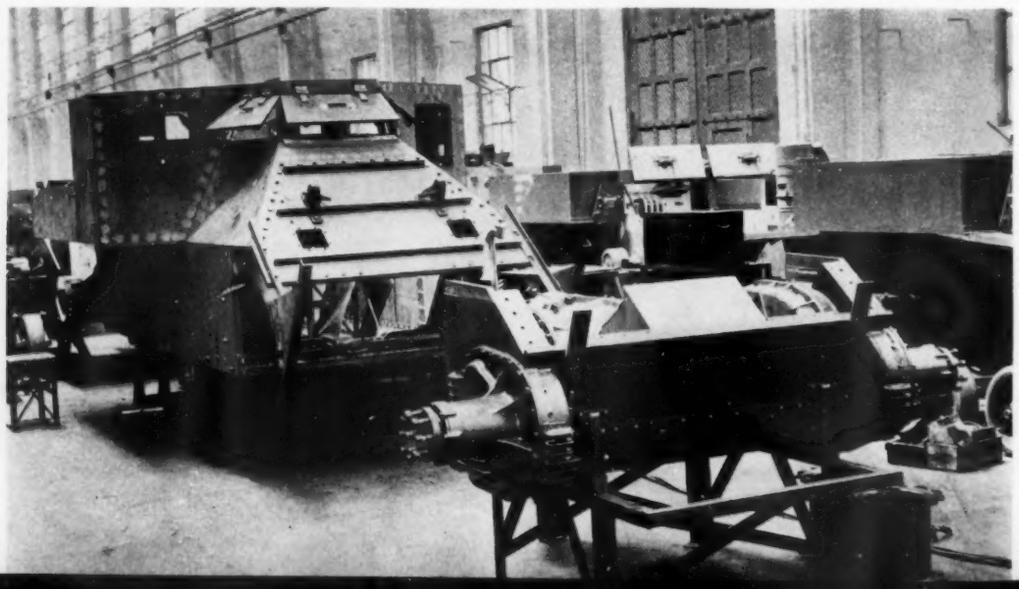


Tank turrets as well as the hulls, primarily an assembly of flat armor plate and structural steel, are assembled by riveting in production line fashion. Rivet holes up to $\frac{5}{8}$ in. diameter are drilled with a $\frac{1}{64}$-in. clearance instead of $\frac{1}{16}$ in. common in riveting practice. The rivet holes in the mating part are drilled $\frac{1}{32}$ in. undersize and reamed on assembly to proper size and location with a bridge reamer. As a further precaution and to insure that the rivet holes are properly filled, a special technique is used in heating the rivets in the gas furnaces which are spaced at convenient intervals along the production line



The arrangement for placing the rivets in the furnace is shown schematically. By placing the rivets as shown the necessary gradation in heat for best driving from end to end is achieved. Approximately 2,100 F. is the temperature at which the furnaces operate. If temperature is less than that the rivets won't fill; if more they will scale. The rivets must be worked only while the "color" is in them. Otherwise they will not fit tightly. On larger assemblies standard riveting hammers are used; large stationary squeezers rivet sub-assemblies

Further along the assembly line internal bracing is being welded inside of the hull. A dummy structure is used to simulate the transmission, shown in the foreground, while the hull is under construction. The complete transmission with its cast armor plate cover is purchased as one assembly from an outside manufacturer. Note the structural steel "legs" and lifting brackets still attached to the front armor plate, which simplify the job of handling this large and heavy part



Tap Standards—II

A STANDARD for cut and ground thread taps has been approved by the American Standards Association. It includes definitions, markings, working tolerances, as well as thread and general dimensions of American National Form Thread for hand taps, machine screw taps, tapper taps, nut taps, pulley taps, boiler taps, mud- or washout-hole taps, staybolt taps, pipe taps, combined pipe taps and drill. Markings and definitions, in addition to thread limits for fractional size taps, were published previously (*AM.* Vol. 84, pages 679 and 681). Thread Limits for additional types and sizes of taps are presented herewith:

AMERICAN NATIONAL FORM THREAD LIMITS

Taper pipe taps—Cut and ground thread

Nominal Size	Threads per Inch, NPT	Gage Measurement[1]			Lead Tolerance per Inch of Thread, Plus or Minus		Angle Tolerance			Taper per Foot, Plus or Minus	
		Projection, Inches	Tolerance, Plus or Minus				Half Angle, Plus or Minus		Full Angle		
			Cut Thread	Ground Thread	Cut Thread	Ground Thread	Cut Thread	Ground Thread	Cut Thread	Cut Thread	Ground Thread
1/8	27	0.312	1/16	1/16	0.003	0.0005	45′	30′	68′	1/16	1/32
1/4	18	0.459	1/16	1/16	0.003	0.0005	45′	30′	68′	1/16	1/32
3/8	18	0.454	1/16	1/16	0.003	0.0005	45′	30′	68′	1/16	1/32
1/2	14	0.579	1/16	1/16	0.003	0.0005	45′	30′	68′	1/16	1/32
3/4	14	0.565	1/16	1/16	0.003	0.0005	45′	30′	68′	1/16	1/32
1	11 1/2	0.678	3/32	3/32	0.003	0.0005	45′	30′	68′	1/16	1/32
1 1/4	11 1/2	0.686	3/32	3/32	0.003	0.0005	45′	30′	68′	1/16	1/32
1 1/2	11 1/2	0.699	3/32	3/32	0.003	0.0005	45′	30′	68′	1/16	1/32
2	11 1/2	0.667	3/32	3/32	0.003	0.0005	45′	30′	68′	1/16	1/32
2 1/2	8	0.925	3/32	3/32	0.003	0.0005	40′	25′	60′	1/16	1/32
3	8	0.925	3/32	3/32	0.003	0.0005	40′	25′	60′	1/16	1/32
3 1/2	8	0.938	1/8	1/8	0.003	0.0005	40′	25′	60′	1/16	1/32
4	8	0.950	1/8	1/8	0.003	0.0005	40′	25′	60′	1/16	1/32

All dimensions are given in inches.

LEAD TOLERANCE. For cut thread taps a maximum lead error of plus or minus 0.003 in. in one inch of thread is permitted, and for ground thread taps a maximum lead error of plus or minus 0.0005 in. in one inch of thread is permitted.

[1] Distance that the small end of tap projects through American Standard Pipe Thread Ring Gage. (See ASA B2.)

Straight pipe taps—Ground thread

AMERICAN STANDARD

Nominal Size	Threads per Inch, NPS	Major Diameter				Pitch Diameter		
		Basic	Min	Max	Pipe[1] Gage	Basic	Min	Max
1/8	27	0.4044	0.4031	0.4041	0.3994	0.3748	0.3753	0.3763
1/4	18	0.5343	0.5321	0.5331	0.5269	0.4899	0.4904	0.4914
3/8	18	0.6714	0.6692	0.6702	0.6640	0.6270	0.6275	0.6285
1/2	14	0.8356	0.8325	0.8335	0.8260	0.7784	0.7789	0.7799
3/4	14	1.0460	1.0430	1.0440	1.0364	0.9889	0.9894	0.9904
1	11 1/2	1.3082	1.3048	1.3063	1.2966	1.2386	1.2396	1.2407

[1] See column 5, Table 57, N.S.T.C., 1933, report.

All American Standard ground thread straight pipe taps made to above limits should produce holes which will accept a basic straight pipe gage.

GREASE CUP FITTING

Nominal Size	Threads per Inch, Grease	Major Diameter			Pitch Diameter		
		Basic	Min	Max	Basic	Min	Max
1/8	27	0.4044	0.3929	0.3944	0.3748	0.3690	0.3700
1/4	18	0.5343	0.5202	0.5217	0.4899	0.4820	0.4830
3/8	18	0.6714	0.6572	0.6587	0.6270	0.6190	0.6200
1/2	14	0.8356	0.8202	0.8217	0.7784	0.7680	0.7695

All dimensions are given in inches.

LEAD TOLERANCE. A maximum lead error of plus or minus 0.0005 in. in one inch of thread is permitted.

ANGLE TOLERANCE.

Threads per Inch	Error in Half Angle
11 1/2 to 27 incl.	30 min plus or minus

MARKING. In addition to regular marking, grease cup fitting taps will be marked NPSG.

Straight pipe taps—Cut thread

AMERICAN STANDARD

Nominal Size	Threads per Inch, NPS	Major Diameter			Pitch Diameter		
		Basic	Min	Max	Basic	Min	Max
1/8	27	0.4044	0.4011	0.4041	0.3748	0.3733	0.3763
1/4	18	0.5343	0.5301	0.5331	0.4899	0.4884	0.4914
3/8	18	0.6714	0.6670	0.6705	0.6270	0.6253	0.6288
1/2	14	0.8356	0.8303	0.8338	0.7784	0.7767	0.7802
3/4	14	1.0460	1.0405	1.0445	0.9889	0.9869	0.9909
1	11 1/2	1.3082	1.3018	1.3058	1.2386	1.2366	1.2406
1 1/4	11 1/2	1.6530	1.6463	1.6508	1.5834	1.5811	1.5856
1 1/2	11 1/2	1.8919	1.8853	1.8898	1.8223	1.8201	1.8246
2	11 1/2	2.3658	2.3590	2.3640	2.2963	2.2938	2.2988

GREASE CUP FITTING

Nominal Size	Threads per Inch, Grease	Major Diameter			Pitch Diameter		
		Basic	Min	Max	Basic	Min	Max
1/8	27	0.4044	0.3924	0.3944	0.3748	0.3680	0.3700
1/4	18	0.5343	0.5197	0.5217	0.4899	0.4810	0.4830
3/8	18	0.6714	0.6567	0.6587	0.6270	0.6180	0.6200
1/2	14	0.8356	0.8192	0.8217	0.7784	0.7670	0.7695

All dimensions are given in inches.

LEAD TOLERANCE. A maximum lead error of plus or minus 0.003 in. in one inch of thread is permitted.

ANGLE TOLERANCE.

Threads per Inch	Error in Half Angle	Error in Full Angle
11 1/2 to 27 incl.	45 min plus or minus	68 min

MARKING. In addition to regular marking, grease cup fitting taps will be marked NPSG.

Keep In . . . Keep Out

More than 25 million New Departure Self-Sealed Bearings have been used, because they . . .

KEEP IN	KEEP OUT
lubricant	dirt
endurance	friction
accuracy	wear

Also . . . they simplify machine design and reduce costs

NEW DEPARTURE

SELF-SEALED BALL BEARINGS

NEW DEPARTURE - DIVISION OF GENERAL MOTORS - BRISTOL, CONNECTICUT - DETROIT - CHICAGO

Tap Standards—II

AMERICAN NATIONAL FORM THREAD LIMITS

Machine screw taps—Cut thread

Screw Gage Number	Threads per Inch NC	NF	NS	Major Diameter Basic	Min	Max	Pitch Diameter Basic	Min	Max
0	..	80	..	0.0600	0.0609	0.0624	0.0519	0.0521	0.0531
1	..	..	56	0.0730	0.0742	0.0757	0.0614	0.0616	0.0626
1	64	..	..	0.0730	0.0740	0.0755	0.0629	0.0631	0.0641
1	..	72	..	0.0730	0.0740	0.0755	0.0640	0.0642	0.0652
2	56	..	..	0.0860	0.0872	0.0887	0.0744	0.0746	0.0756
2	..	64	..	0.0860	0.0870	0.0885	0.0759	0.0761	0.0771
3	48	..	..	0.0990	0.1003	0.1018	0.0855	0.0857	0.0867
3	..	56	..	0.0990	0.1002	0.1017	0.0874	0.0876	0.0886
4	..	..	32	0.1120	0.1142	0.1162	0.0917	0.0922	0.0937
4	..	..	36	0.1120	0.1137	0.1157	0.0940	0.0942	0.0957
4	40	..	..	0.1120	0.1136	0.1156	0.0958	0.0960	0.0975
4	..	48	..	0.1120	0.1133	0.1153	0.0985	0.0987	0.1002
5	40	..	..	0.1250	0.1266	0.1286	0.1088	0.1090	0.1105
5	..	44	..	0.1250	0.1264	0.1284	0.1102	0.1104	0.1119
6	32	..	..	0.1380	0.1402	0.1422	0.1177	0.1182	0.1197
6	..	..	36	0.1380	0.1397	0.1417	0.1200	0.1202	0.1217
6	..	40	..	0.1380	0.1396	0.1416	0.1218	0.1220	0.1235
8	32	..	..	0.1640	0.1662	0.1682	0.1437	0.1442	0.1457
8	..	36	..	0.1640	0.1657	0.1677	0.1460	0.1462	0.1477
8	..	..	40	0.1640	0.1656	0.1676	0.1478	0.1480	0.1495
10	24	..	..	0.1900	0.1928	0.1948	0.1629	0.1634	0.1649
10	..	..	30	0.1900	0.1923	0.1943	0.1684	0.1689	0.1704
10	..	32	..	0.1900	0.1922	0.1942	0.1697	0.1702	0.1717
12	24	..	..	0.2160	0.2188	0.2208	0.1889	0.1894	0.1909
12	..	28	..	0.2160	0.2184	0.2204	0.1928	0.1933	0.1948
12	..	..	32	0.2160	0.2182	0.2202	0.1957	0.1962	0.1977
14	..	..	20	0.2420	0.2452	0.2477	0.2095	0.2100	0.2120
14	..	..	24	0.2420	0.2448	0.2473	0.2149	0.2154	0.2174

All dimensions are given in inches.

LEAD TOLERANCE. A maximum lead error of plus or minus 0.003 in. in one inch of thread is permitted.

ANGLE TOLERANCE.

Threads per Inch	Error in Half Angle	Error in Full Angle
20 to 28 incl.	45 min plus or minus	68 min
30 and finer	60 min plus or minus	90 min

Straight boiler and staybolt taps—Cut thread

Size	Threads per Inch, NF	Major Diameter Basic	Min	Max	Pitch Diameter Basic	Min	Max
1/2	12	0.5000	0.5010	0.5040	0.4459	0.4464	0.4489
9/16	12	0.5625	0.5635	0.5665	0.5084	0.5089	0.5114
5/8	12	0.6250	0.6260	0.6290	0.5709	0.5714	0.5739
11/16	12	0.6875	0.6885	0.6925	0.6334	0.6339	0.6369
3/4	12	0.7500	0.7510	0.7550	0.6959	0.6964	0.6994
13/16	12	0.8125	0.8135	0.8175	0.7584	0.7589	0.7619
7/8	12	0.8750	0.8760	0.8800	0.8209	0.8214	0.8244
15/16	12	0.9375	0.9385	0.9425	0.8834	0.8839	0.8869
1	12	1.0000	1.0010	1.0050	0.9459	0.9464	0.9494
1 1/16	12	1.0625	1.0635	1.0675	1.0084	1.0089	1.0119
1 1/8	12	1.1250	1.1265	1.1310	1.0709	1.0714	1.0749
1 3/16	12	1.1875	1.1890	1.1935	1.1334	1.1339	1.1374
1 1/4	12	1.2500	1.2515	1.2560	1.1959	1.1964	1.1999
1 5/16	12	1.3125	1.3140	1.3185	1.2584	1.2589	1.2624
1 3/8	12	1.3750	1.3765	1.3810	1.3209	1.3214	1.3249
1 7/16	12	1.4375	1.4390	1.4435	1.3834	1.3839	1.3874
1 1/2	12	1.5000	1.5015	1.5060	1.4459	1.4464	1.4499

All dimensions are given in inches.

LEAD TOLERANCE. A maximum lead error of plus or minus 0.003 in. in one inch of thread is permitted.

ANGLE TOLERANCE

Threads per Inch	Error in Half Angle	Error in full Angle
12	45 min plus or minus	68 min plus or minus

Machine screw taps—Ground thread

COMMERCIAL GROUND

Screw Gage Number	Threads per Inch NC	NF	NS	Major Diameter Basic	Min	Max	Pitch Diameter Basic	Min	Max
3	48	..	..	0.0990	0.1000	0.1010	0.0855	0.0857	0.0867
3	..	56	..	0.0990	0.0995	0.1005	0.0874	0.0876	0.0886
4	..	..	36	0.1120	0.1135	0.1145	0.0940	0.0942	0.0952
4	40	..	..	0.1120	0.1135	0.1145	0.0958	0.0960	0.0970
4	..	48	..	0.1120	0.1130	0.1140	0.0985	0.0987	0.0997
5	40	..	..	0.1250	0.1265	0.1275	0.1088	0.1090	0.1100
5	..	44	..	0.1250	0.1260	0.1270	0.1102	0.1104	0.1114
6	32	..	..	0.1380	0.1400	0.1410	0.1177	0.1182	0.1192
6	..	40	..	0.1380	0.1395	0.1405	0.1218	0.1220	0.1230
8	32	..	..	0.1640	0.1660	0.1670	0.1437	0.1442	0.1452
8	..	36	..	0.1640	0.1655	0.1665	0.1460	0.1462	0.1472
10	24	..	..	0.1900	0.1930	0.1940	0.1629	0.1634	0.1644
10	..	32	..	0.1900	0.1920	0.1930	0.1697	0.1702	0.1712
12	24	..	..	0.2160	0.2190	0.2200	0.1889	0.1894	0.1904
12	..	28	..	0.2160	0.2185	0.2195	0.1928	0.1933	0.1943
14	..	..	20	0.2420	0.2460	0.2470	0.2095	0.2100	0.2110
14	..	..	24	0.2420	0.2450	0.2460	0.2149	0.2154	0.2164

PRECISION GROUND

Screw Gage Number	Threads per Inch NC	NF	NS	Major Diameter Basic	Min	Max	Pitch Diameter Basic	Min	Max
0	..	80	..	0.0600	0.0605	0.0615	0.0519	0.0519	0.0524
1	..	..	56	0.0730	0.0735	0.0745	0.0614	0.0614	0.0619
1	64	..	..	0.0730	0.0735	0.0745	0.0629	0.0629	0.0634
1	..	72	..	0.0730	0.0735	0.0745	0.0640	0.0640	0.0645
2	56	..	..	0.0860	0.0865	0.0875	0.0744	0.0744	0.0749
2	..	64	..	0.0860	0.0865	0.0875	0.0759	0.0759	0.0764
3	48	..	..	0.0990	0.1000	0.1010	0.0855	0.0855	0.0860
3	..	56	..	0.0990	0.0995	0.1005	0.0874	0.0874	0.0879
4	..	..	36	0.1120	0.1135	0.1145	0.0940	0.0940	0.0945
4	40	..	..	0.1120	0.1135	0.1145	0.0958	0.0958	0.0963
4	..	48	..	0.1120	0.1130	0.1140	0.0985	0.0985	0.0990
5	40	..	..	0.1250	0.1265	0.1275	0.1088	0.1088	0.1093
5	..	44	..	0.1250	0.1260	0.1270	0.1102	0.1102	0.1107
6	32	..	..	0.1380	0.1400	0.1410	0.1177	0.1177	0.1182
6	..	40	..	0.1380	0.1395	0.1405	0.1218	0.1218	0.1223
8	32	..	..	0.1640	0.1660	0.1670	0.1437	0.1437	0.1442
8	..	36	..	0.1640	0.1655	0.1665	0.1460	0.1460	0.1465
10	24	..	..	0.1900	0.1930	0.1940	0.1629	0.1629	0.1634
10	..	32	..	0.1900	0.1920	0.1930	0.1697	0.1697	0.1702
12	24	..	..	0.2160	0.2190	0.2200	0.1889	0.1889	0.1894
12	..	28	..	0.2160	0.2185	0.2195	0.1928	0.1928	0.1933

All dimensions are given in inches.

LEAD TOLERANCE. A maximum lead error of plus or minus 0.0005 in. in one inch of thread is permitted.

ANGLE TOLERANCE.

Threads per Inch	Error in Half Angle
20 to 80 incl.	30 min plus or minus

Bent-shank tapper taps—Cut thread

Size	Threads per Inch, NF	Major Diameter Basic	Min	Max	Pitch Diameter Basic	Min	Max
1/4	28	0.2500	0.2519	0.2544	0.2268	0.2263	0.2283
5/16	24	0.3125	0.3148	0.3173	0.2854	0.2849	0.2869
3/8	24	0.3750	0.3768	0.3793	0.3479	0.3469	0.3489
7/16	20	0.4375	0.4392	0.4422	0.4050	0.4035	0.4060
1/2	20	0.5000	0.5017	0.5047	0.4675	0.4660	0.4685
9/16	18	0.5625	0.5645	0.5675	0.5264	0.5249	0.5274
5/8	18	0.6250	0.6270	0.6300	0.5889	0.5874	0.5899
3/4	16	0.7500	0.7519	0.7559	0.7094	0.7074	0.7104

All dimensions are given in inches.

LEAD TOLERANCE. A maximum lead error of plus or minus 0.003 in. in one inch of thread is permitted.

ANGLE TOLERANCE.

Threads per Inch	Error in Half Angle	Error in Full Angle
16 to 28 incl.	45 min plus or minus	68 min plus or minus

MORE PRODUCTION

WITH G. T. D. HIGH SPEED TAPS

Do you want faster production? This company did — on these heavy duty cast brass elbows. They got it, too, when they adopted G. T. D. Greenfield High Speed Ground Thread 7/16-24 Taps. Average production was stepped up from 1050 to 1220 per hour, a 16% increase. And production per tap went from 9,000 to 12,000, up 33⅓ %. These increases represented clear savings because they used the same machine, and even the same cutting lubricant.

G. T. D. Greenfield solicits the opportunity to make equally good in your plant. Our standard and special threading tools are backed by the accumulated experience of over 75 years, all of which is at your disposal. Get in touch with your local distributor or with a G. T. D. Engineer.

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Priorities

PRIORITIES is a word which manufacturers dislike. It suggests government regulation and control of their business. It revives memories of painful headaches back in World War days. It engenders fears of further regimentation of industry in a world rapidly becoming undemocratic.

Yet industrialists realize that in a time of grave emergency, such as the present, nothing should stand in the way of the Army and Navy and munitions makers getting machine tools and other defense materials ahead of other buyers.

If government-imposed priorities are the only means of seeing that defense industries get what they need as quickly as possible, let's have such priorities. But there is reason to believe that voluntary cooperation may work and that legal priorities may be unnecessary.

That appears to be the line of thought of the National Defense Advisory Commission, the Army and the Navy in adopting a system of preference ratings on defense contracts. The system, in essence, sets up preferred deliveries on equipment and materials for these contracts and depends for its enforcement upon the voluntary cooperation of industry. As long as delivery dates are met, adjustments of production schedules are to be left to the manufacturers.

At first, preference ratings probably will be applied more extensively in machine tools than anywhere else. If they work there, defense officials will be favorably disposed toward using them in other branches of industry.

How the system will function will depend upon teamwork. It is clear that a recalcitrant attitude on the part of a few may easily spoil the commendable conduct of the overwhelming majority. That is why it is so important that every member of the industry do his part.

Says the National Defense Advisory Commission, "Continuance of the proposed voluntary system depends on complete voluntary cooperation of government and industry. . . . The Commission favors continuance . . . *until it appears that more authoritative measures are required.*"

Recent history of the machine tool industry gives hope that the preference rating system has a good chance of success. Builders have sharply increased their output and plant capacity without losing their heads. When aircraft engine makers got in a bad jam and asked for help, the machine tool people saw that machines reached the right spot at the right time. When the Navy wanted plate planers in a hurry, a number of companies worked together to shorten delivery dates by months. The machine tool industry's defense committee has labored tirelessly to see that machines required the worst for defense purposes were produced and delivered the fastest.

While a solemn obligation rests on industry to see that the preference rating system operates efficiently, a like responsibility rests on Army and Navy officials to do first things first. Especially in machine tools, if these officials become unreasonable and expect equipment to be delivered to a specified point before it can be used, no good will be accomplished and an injustice will be done the manufacturers. Surely orders can be spaced out so that the government will benefit to the maximum from machine tool builders' output, and so that the builders in turn can do the best possible job.

If both parties to the defense program—the government and industry—will go at their tasks in a spirit of cooperation, of appreciation of each other's problems and of genuine patriotism, the country will be the winner.

Burnham Finney

GAGING BUSINESS

Machine tools totaling $600,000,000 needed for defense program. Most U. S. machines bought by British still being sent to England. Chrysler will build five tanks each 8-hour shift

An avalanche of defense orders is expected to descend on the metalworking industry in the next thirty days, assuring thousands of plants of the busiest winter in their history. Employment and payrolls will not rise sharply immediately, however, because the tooling up process prior to mass production will take many weeks, and in some cases months. One of the industry's main worries is the acute shortage of labor which looms ahead.

Machine Tools—With an estimated $600,000,000 of machine tools needed for the defense program in the next year and a half, machine tool builders, coordinating with the government plan, are instituting an intensive system of voluntary priorities which applies not only to them, but also to sub-contractors. This system will give right-of-way to defense orders over all others. An impression abroad that the industry will not take any further business from companies making peacetime goods is incorrect. Actually, however, machine tool builders' plants are filled to overflowing with bookings for defense and for the British. The big influx of orders the past fortnight has shoved deliveries farther back. Whether the industry will have to expand its plant capacity much further is a moot question. Capacity now is 30 per cent greater than last September, most factories are working 20 out of 24 hours a day, and some companies have as many as 43 sub-contractors producing parts for them. If Army and Navy needs are spread out over the next 18 months, instead of concentrated in a much shorter period, the industry can meet specified deliveries without stretching plants beyond present capacities. Despite heavy bombings in England, the British are having most of the machine tools bought in this country shipped to England. Only a small percentage currently is going to Canada and to Australia or to U. S. plants with British contracts.

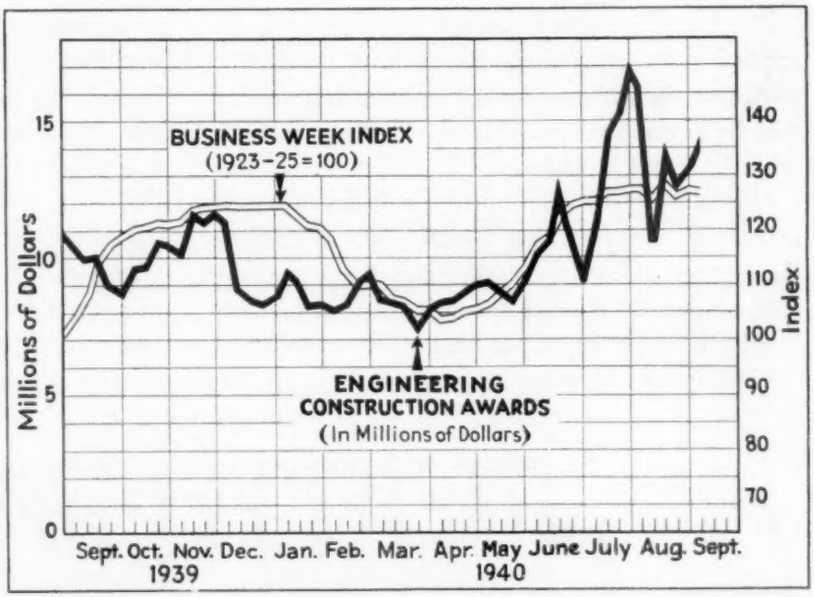
Munitions—Sites for 16 munitions plants have been selected by the Army and the money for them is available, but locations are not yet being divulged because of political pressure from disappointed communities. The Army is prepared to let huge munitions contracts almost immediately, now that the status of new plant amortization and taxes is being cleared up by Congressional legislation. Chrysler will build 1,000 tanks on its initial order at cost of $33,500 each. A subsequent order for 1,000 more tanks can be handled for $28,500 each. Production will be on a basis of five tanks per day on a single shift, for which 6,000 men will be needed. The British are still trying to arrange for production of 4,000 tanks in this country.

Aircraft—Airplane makers are in the midst of an expansion program which will virtually double their manufacturing space. With the placing of some 4,000 planes shortly by the government, backlogs will be close to $2,000,000,000. Present production is about 900 planes a month. It is understood most of the combat ships completed are going to the British. Allison Division of General Motors is said to be up to 130 motors a month and will touch 400 a month before the year is out. Within eight months Ford expects to be building Pratt & Whitney motors, the goal being one motor an hour.

Railroad Equipment—Freight car purchases in the final half of 1940 should touch 40,000 units. Over 11,000 cars were ordered in July and August, representing the best summer buying in over 10 years. Around 400 cars and 21 diesel-electric locomotives were bought in the first two weeks of September. Electro-Motive Corp. is adding 75,000 square feet to its floor space and currently is turning out about 20 diesel-electric locomotives a month. Pullman, American Locomotive and J. G. Brill have bid on gun carriages for the U. S. Army.

Farm Equipment—With farm income five per cent higher than last year, farm equipment sales should be $450,000,000 for 1940. Exports are running 30 per cent above last year, most of the gain being in tractor and tillage equipment. Production is mostly down to a single shift, though some plants are still working two shifts on tractor parts. Minneapolis-Moline is erecting a new sheet metal and combine assembly plant to cost $300,000.

Steel—Output is above 90 per cent and is expected to stay there the remainder of the year. If the war continues, a scarcity of steel may develop next spring. Even should the war end, the defense program will keep consumption at a high rate. Steel inventories are relatively high, but not dangerously so in view of present broad industrial operations.



Voluntary System of Priorities Adopted For Machine Tools For Defense Contracts

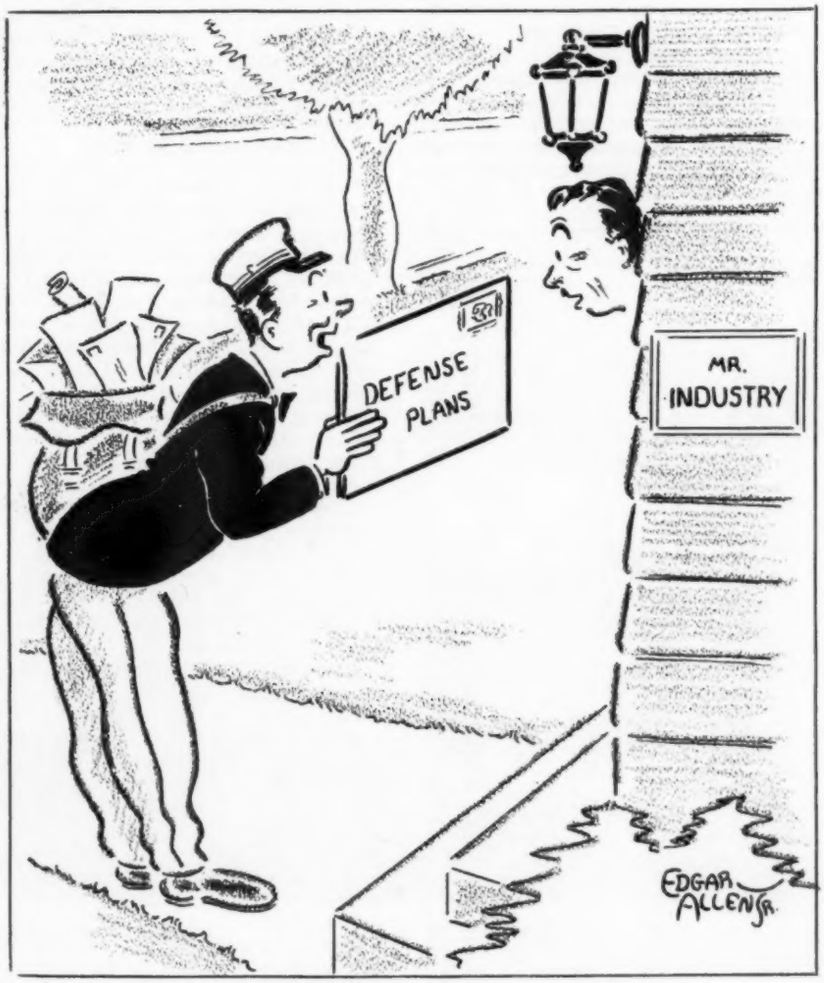
WASHINGTON—Preference classifications are to be given to all machine tool orders for the defense program and machine tool builders are being asked voluntarily to accept such ratings without the necessity of the government resorting to legally enforced priorities.

General classifications to be employed are class AA, reserved for future emergencies of exceptional nature, and class A, consisting of such Army and Navy orders as require specially preferred treatment. Each of these classifications will be subdivided as far as may be necessary: For example, AA1, AA2, A, A1, A2, etc. In addition to the preference classification, each government order will carry a desired delivery date, and delivery date is the primary consideration.

A high preference rating does not mean that work on or delivery of orders bearing a lower classification or orders for private account or for export should be delayed, unless necessary to meet the delivery date on the order bearing a superior preference rating. As long as delivery dates are met, details of adjustment will be left primarily to the industry itself. The Army, Navy and Defense Commission will assist.

Under supervision of the government contracting officer, a prime contractor is authorized to extend the preference rating to his subcontractors, including materials, services, production machinery or equipment required for completion of the contract. If the contractor's problem of getting equipment and supplies still is acute, he should refer his case to the Priorities Committee of the Army and Navy Munitions Board, Room 2010 Munitions Building, Washington. Requests for preference ratings by the industry should be made to the Priorities Committee.

The preference rating system follows the same procedure as if legal priorities had been invoked. Its success depends on hearty cooperation by every manufacturer.



"I hope it's an order, not an eviction notice."

FORGING CAPACITY EXPANDING

WASHINGTON—An expansion of private heavy forging capacity costing about $40,000,000 has been worked out between the Defense Commission and the steel industry. The capacity is needed both for ship forgings as well as for big guns and shells. Part of the cost will be met by government advances and part will be financed by the firms themselves. In addition, the government itself will increase its facilities for forging shafting at the South Charleston naval ordnance plant. The Navy, moreover, will buy a 14,000-ton press and intensifier and several smaller presses to be installed in a steel company.

Contracts for 200 Warships Completed; To Cost $3,861,053,321

WASHINGTON—A few hours after the President signed the five billion dollar supplemental defense appropriation, the Navy completed contracts for nearly four billion dollars worth of warships—the whole 200 ships needed to complete the authorized 70 per cent expansion of the Navy and build a two-ocean fleet. The appropriation bill provides the $183,000,000 needed to pay for this year's portion of the work; a substantial portion of this money will be spent for construction facilities at the private yards, rather than for the ships themselves, but it is hoped to have most of the keels down this year. The new contracts call for 7 battleships, 27 cruisers, 8 aircraft carriers, 115 destroyers, and 43 submarines, plus 1 repair ship. All of the battleships, 7 of the destroyers, and 8 of the submarines will be built in Navy Yards, but the rest will be privately constructed. The total cost of construction of these vessels is $3,861,053,321, which includes the cost of armor and armament, and in the case of submarines, also includes government-finished machinery.

The contracts have been let as follows: Newport News, 4 aircraft carriers and 2 cruisers; Bethlehem Steel Co., 4 aircraft carriers, 10 cruisers and 34 destroyers; New York Shipbuilding Corp., 10 cruisers; Federal Shipbuilding & Drydock Co., 5 cruisers and 17 destroyers. Seattle Tacoma Shipbuilding Co., 20 destroyers; Consolidated Steel Corp., Ltd., Orange, Texas, 12 destroyers.

Bath Iron Works Corp., Bath, Maine, 11 destroyers; Electric Boat Co., Groton, Conn., 25 submarines; Manitowoc Shipbuilding Co., Manitowoc, Wis., 10 submarines; Los Angeles Shipbuilding & Drydock Co., Los Angeles, Calif., 1 repair ship; Gulf Shipbuilding Corp., Chickasaw, Ala., 4 destroyers. All others are being built in government navy yards.

KNUDSEN EXPECTS 3000 PLANES A MONTH BY 1942

2,200 engines a month is present output. Gigantic plant expansion aid increased production; many get RFC loans

WASHINGTON — Defense Commissioner Knudsen, on an inspection trip with Air Corps Chief Gen. Arnold, said the defense schedule calls for peak production of 3,000 planes per month by July, 1942, and by April of that year a total of 33,000 planes should have been built, of which 14,000 will have gone to Britain. Of the 19,000 for the U. S. 60 per cent will be combat types, and the rest will be cargo, transport, and trainer planes. The present output of engines is 2,200 a month. By July, 1941, this figure should be 3,500 per month.

To prepare for this accelerated output the plane industry has been expanding plants, facilities and research equipment at a great speed during the past 12 months. Much of the improvement has been accomplished with private funds. However, in recent months the government-financed Reconstruction Finance Corp. has loaned millions of dollars to the aviation industry. A summary of recent aircraft and engine plant expansion in progress or projected follows:

Packard Motor Company: spending $30,000,000 of its own money plus $8,000,000 RFC loan for plant to produce 9,000 Rolls Royce engines, beginning in 10 months at 20 engines per month, increasing to 840 per month in 15 months from contract date. Expect to employ 14,000 workers in addition to present 10,000. It is understood that Britain is furnishing some of the capital against future delivery of engines.

$92,000,000 RFC Loan

Wright Aeronautical: spending $92,000,000 RFC money for plant space which will increase capacity to 12,000 engines a year. About $37,000,000 will go into a new 1,000,000 sq. ft. plant at Lockland, Ohio, which will employ 12,000 to 15,000 workers. Some of the balance will go to subcontractors' plant increases. One is Studebaker which will make Wright parts in expanded plant at South Bend and at Detroit. About $2,000,000 of the RFC loan will go into the Curtiss propeller plant at Caldwell, N. J. $8,000,000 will be spent for machine tools at Wright's plant in Cincinnati.

Curtiss - Wright Corp., Buffalo: spending $51,160,000 RFC money for new aircraft plants and equipment at Buffalo, Columbus, Ohio, and St. Louis. This includes $15,000,000 for labor and materials, and $2,160,000 for machinery and equipment which will total $51,160,000.

Douglas Aircraft Co.: spending $20,000,000 of private funds for expansion at Santa Monica, a new plant at Long Beach, small plant at El Segundo. A total of 31,110,000 sq. ft. will double the company's present floor space.

Pratt & Whitney (Division of United Aircraft): spending $15,000,000 of private funds to expand the East Hartford plant, double floor space of Vought-Sikorsky, add another bay to Hamilton Standard Propeller. Most construction contracts have been let and large machine tool purchases are under way. The company already has spent $16,000,000 in the last 18 months for a new plant. Employees have increased over same period from 5,000 to 15,000. To meet its Army-Navy quota P & W will license Ford Motor Co. to build 1650 hp. double row Wasp engines at $1 license fee per engine.

Glenn L. Martin Co.: spending $24,000,000 of private funds to increase floor space 1,000,000 ft. to near 3,000,000 ft. The company recently expanded its plant in record time of 77 days and claims to be the first to break ground in the defense program without waiting for amortization legislation. It expects to have new space in production by New Year.

Ford Will Build Plant

Ford Motor Company: will build a new plant on the Rouge for production of Pratt & Whitney engines undoubtedly using private funds. Equipment needs are being surveyed. Ford is reported about ready to start production of his own liquid-cooled engine, presumably based on the Rolls Royce design which he had in the works for months and finally dropped.

Boeing Aircraft Co.: spending $10,500,000 RFC money for increased plant, two thirds of it at Seattle and the remainder at Wichita, where the company's Stearman plant produces primary trainers.

Consolidated Aircraft Corporation: spending $1,050,000 on an 82 per cent plant expansion. The number of employees will increase from 9,600 men to 15,000 by Christmas.

Aviation Manufacturing Corp.: spending $1,800,000 for a 4-year expansion program.

Vultee Aircraft Inc.: recently took over Stinson Division of Aviation Manufacturing Corp., has completed a new factory at Nashville, and is planning further expansion.

Lockheed Aircraft Co.: spending $5,500,000 of its own money for expansion of its Vega Airplane Co. plant in California.

Beech Aircraft Corp.: building a new plant at Wichita.

Bellanca Aircraft Corp.: planning to spend $1,000,000 for a new plant at

Exports of Machinery During July, 1940

	July 1940	June 1940	July 1939
Electrical Machinery and Apparatus	$8,890,619	$9,607,069	$8,988,257
Power generating machinery except automotive and electrical	1,522,951	2,126,581	1,154,835
Construction and conveying machinery	2,352,152	3,115,301	2,912,134
Mining, well and pumping machinery	4,746,107	3,788,489	4,940,898
Power-driven, metal-working machinery	14,906,312	18,564,300	9,358,876
Other metal-working machinery	582,087	596,917	340,843
Textile machinery	937,061	1,093,851	620,100

Metal-Working Machinery

Engine lathes	$727,930	$1,530,297	$554,419
Turret lathes	1,019,565	1,451,624	698,572
Other lathes	629,638	888,025	317,785
Vertical boring mills and chucking machines	307,944	809,499	638,737
Thread cutting and automatic screw machines	523,749	1,120,424	528,345
Knee and column type milling machines	587,325	367,955	628,809
Other milling machines	1,315,960	1,438,827	1,223,758
Gear cutting machines	484,344	798,420	331,371
Vertical drilling machines	142,756	261,353	106,998
Radial drilling machines	206,836	200,808	24,609
Other drilling machines	494,947	714,837	140,191
Planers and shapers	855,283	338,424	382,717
Surface grinding machines	167,122	298,060	283,993
External cylindrical grinding machines	399,939	437,110	209,248
Internal grinding machines	485,327	562,989	480,129
Tool grinding, cutter grinding, and universal grinding machines	354,798	306,839	283,034
Other metal-grinding machines and parts	909,175	748,398	374,756
Sheet and plate metal-working machines and parts	1,850,366	714,319	353,550
Forging machinery and parts	337,997	763,117	301,374
Rolling mill machinery and parts	1,006,770	2,884,832	588,126
Molding machines	221,124	23,690	4,061
Other foundry equipment and parts	90,159	176,041	74,708
Other power-driven metal-working machinery and parts	1,976,694	1,723,787	829,356
Pneumatic portable tools	102,356	73,285	91,278
Other portable and hand or foot-operated metal-working machines and parts	147,000	174,436	103,354
Chucks for machine tools	70,488	56,508	28,735
Milling cutters, machine-operated threading dies, and taps and similar machine operated metal cutting tools	107,030	106,649	51,058
Other metal-working machine tools and parts	155,213	186,039	66,418

Yonkers, N. Y. The company will build speed boats in addition to airplanes.

Bell Aircraft Corp.: doubling its space at Buffalo.

Brewster Aeronautical Corp.: enlarging plants at Newark, N. J., and on Long Island.

Grumman Aircraft and Engineering, Bethpage, Long Island: expanding its plant to fill a $7,000,000 order for Navy bombers.

Republic Aviation Corp.: increasing its total floor space from 218,000 to 850,000 square feet.

Fairchild Aviation: has tripled the space of its engine plant at Hagerstown, Md., and is said to be negotiating with RFC for a loan.

Bendix Aviation Co.: has a commitment for a $17,000,000 RFC loan for plant extension and additional machinery.

Fleetwings, Inc.: will spend $1,000,000 for a plant at Dallas, Texas.

New Plants Go Up in Far East; Germany Plans Two Subsidiaries

TOKYO—The Shoun Machine Tool Manufacturing Co., which recently raised its share capital to $585,000, has begun construction on a new plant at Ofuna, near Yokohama. The AEG concern of Germany (Allgemeine Elektricitatsgesellschaft) has completed arrangements for the establishment of two subsidiaries in the Far East. The proposed companies will produce electric and general machinery in competition with the existing plants.

Shell Production Problems Discussed At A.S.M.E. Meeting in Pittsburgh

PITTSBURGH — James L. Walsh, chairman of the A.S.M.E. committee on national defense, presided at a meeting on shell manufacture September 11 which was attended by almost 300 army ordnance officers, manufacturing representatives interested in shell production, and machine tool builders. It now tentatively is planned to hold a similar meeting in Cincinnati October 16 and 17.

Col. B. O. Lewis, asst. chief of ordnance, U. S. Army, said present plans call for providing complete equipment for 1,200,000 men, critical items for 800,000 additional men, including armament and bombs for 18,000 airplanes. Shell components probably will be made in scattered industrial plants, assembled in loading plants, operated by the Ordnance Department. Some improvising will be necessary to get the program under way rapidly.

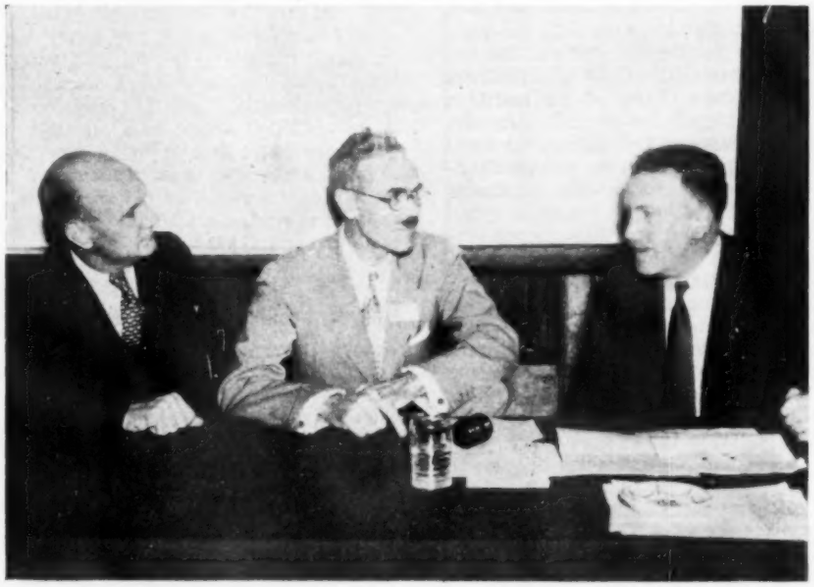
Frederick G. Schranz, general manager, Baldwin-Southwark Division, Baldwin Locomotive Works, discussed hydraulic and mechanical methods of forging shell. Forging machine methods were described by J. H. Friedman, vice-president, National Machinery Co., who used motion pictures to illustrate his talk. He pointed out the striking similarity between the forging of automobile drag links and the forging of shell.

James Hopkins, of Salem Engineering Corp., outlined the process developed by Claude Witter for producing shells from forged blanks in what fundamentally is a seamless tube rolling machine. By this process a forged 75-mm. shell can be produced from a 16-lb. billet.

Lt. Col. A. B. Johnson, U. S. Army, office of the asst. secretary of war, pointed out that many million shells probably will be needed during the next year to meet U. S. Army and British requirements.

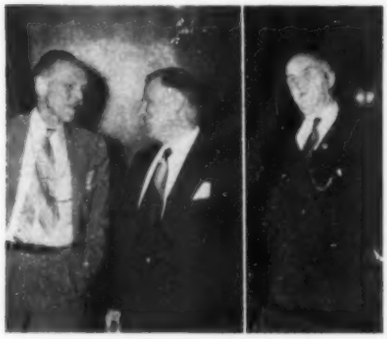
Col. E. C. Bomar, Capt. Alford and Charles Grazioso, of Frankford Arsenal, described methods now being used for machining shell, using a moving picture to show the machines and tools at work on a conveyorized shell line. Col. Bomar pointed out the advantages of using a finished forged bore, stating that it had been a boon to the machine line.

E. P. Blanchard, of the Bullard Co., pointed out some of the elements of design that make some foreign shells difficult to machine, and discussed differences in methods of machining used in this and other countries. He told the group that during 1938 more than half of the shells made in England were produced in German-made machines tooled with Widia.

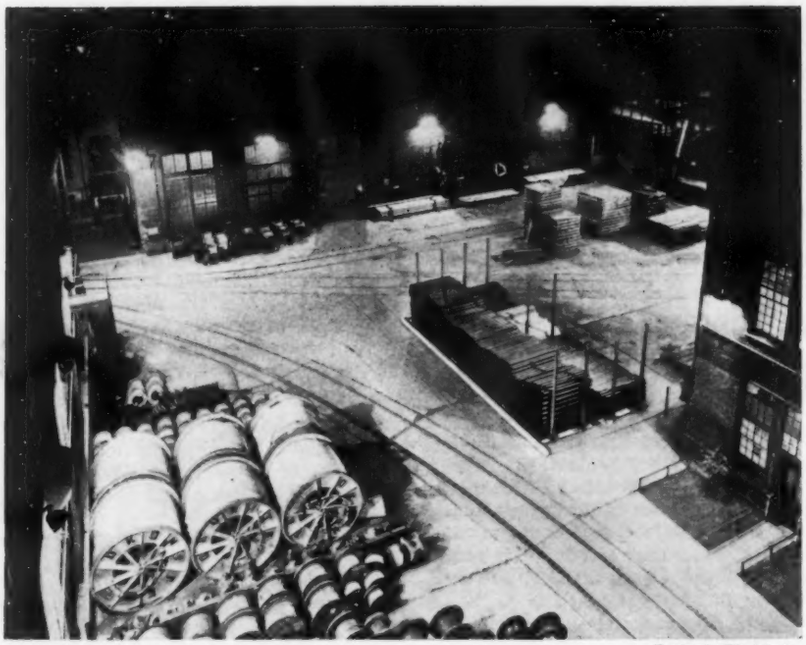


Attentive Listeners—*All those who attended the A.S.M.E. meeting found the comment on shell manufacture of great interest. Above, James L. Walsh, (right) chairman of the A.S.M.E. committee on defense, holds the attention of Col. E. C. Bomar (left) and Lt. Col. A. B. Johnson*

Above, J. H. Friedman, P. H. Miller, and James R. Longwell (left to right) listen to speaker at A.S.M.E. meeting in Pittsburgh



Above, E. P. Blanchard of Bullard Co. (left) talks to Carl Bintz of Wicks Bros. while Frederick G. Schranz listens to the proceedings



Benjamin Electric Co.

Floodlights Prevent Sabotage—*Industry is protecting itself against sabotage by the increased use of floodlights and the government has urged all public utilities to use this method of preventing damage. General yard lighting also facilitates night operations*

Japan May Nationalize Machine Tool Plants; Firms Make High Profit in Last Six Months

TOKYO—Bills relating to a large scale nationalization of the existing smaller machine tool building concerns, as a retaliatory measure to meet American restrictions on exports, are expected to be introduced in the coming session of the Diet. The draft bill is based on memoranda by Army and Navy leaders who are calling for increased supplies of precision gear cutters, dies, turret lathes, grinders, micrometers, graduators and calipers. Many of the smaller plants are handicapped by lack of equipment, with the result that workers with designing talent and technical experience are not fully employed. Amalgamation of the smaller plants is recommended.

Officials are citing the German coordination of industry which results in optimum production. It is pointed out that there are but 200 machine tool builders in Germany while Japan has over a thousand. By a process of merging it is proposed to decrease this number to 400 plants qualifying for special privilege on account of superior technique and large capacity.

Another cue taken from Germany is embodied in the proposal to compel machine tool makers to plough back a portion of their profits into plant expansion and research. The present system is like that in the United States: companies are unwilling to reinvest their earnings because of a high tax on profits.

Employment Increases

Since the outbreak of the Sino-Japanese war three years ago, employment in the machinery and tool industries has increased 121 per cent. A survey by the government Bureau of Statistics disclosed that 32,000 workers have found employment in the machinery industry during the last six months. This brings the total to 462,000. In addition, 487,000 workers are employed in the shipbuilding, rolling-stock, automotive and aircraft industries. This is an increase of 24,000 over six months ago.

Latest balance sheets of the leading Japanese machine tool makers disclose a uniformly fine profit, with no firm paying dividends of less than 10 per cent. All firms realized profits of 30 per cent or better against paid-up capital which has left ample reserves to be ploughed back into expansion projects or to be written off against depreciation. Most firms earned higher profits than a year ago.

Meanwhile imports of machine tools, parts and accessories have decreased for the first five months of 1940. During this period imports were valued at $15,116,400, as compared with $19,635,200 for the corresponding period of 1939

McKenna Metals Co. Decrease Prices; Small Buyers Gain

LATROBE, PA.—The McKenna Metals Co. has announced a new low price schedule on standard Kennametal tools and blanks. The feature of the new schedule on standard tools and blanks for turning, facing and boring of steel castings, forgings and bar stock is that small shops get the same price as previously available only to a few large buyers. There are lower tool making charges on standard tools, and tools now are furnished ground ready for use. The new price list is known as No. 4.

Carboloy Co. Reduces Prices, Also Standardizes Carbide Tools

DETROIT—A sharp reduction has been made in the price of carboloy cutting tools by the Carboloy Co., Inc. The new price schedule has been made possible by economies resulting from mass production, together with standardization of a simplified line of tools comprising but five styles in three grades. The new standardized line is designed to cover 80–90 per cent of all applications of cemented carbide tools. The new tools will be carried in stock, ready for shipment, completely ground and ready for use, including even the grinding-in of chip breakers on tools designed for machining of steel.

Typical new standard tool at $1.85 compares with tools previously costing $5.84 in lots of one. In quantities of 50 or more the tools now cost 90 cents. This is the sixth price reduction on cemented carbide metals since 1929. Of the three standardized grades of tools, one completely new grade is for steel cutting and two for cast iron. Mass production was given impetus when the company put into operation its new million dollar plant in 1939. The price reductions apply to special tools, tool bits, dies, wear resisting inserts, etc., the extent of the reduction depending on the amount of carbides used in each type.

NYA Will Soon Launch Training Program for Machine Shop Practice

CINCINNATI—The National Youth Administration in this area will soon inaugurate a training program for machine shop practice. Funds have already been appropriated and equipment, including lathes, milling machines, drills, screw machines, etc., has been purchased. Classes will meet in a staggered system to accommodate approximately 600 trainees. Instruction will be held under the direction of several Cincinnati shop executives who have been retained by the NYA for this purpose.

WATCHING WASHINGTON

Transfer of World War tanks to Canada regarded as initial step toward much broader moves to aid the British. House will vote on "bankable contract." No merchantship curtailment

By BLAINE STUBBLEFIELD

WASHINGTON — About 300 World War tanks being sold to Canada "for training purposes" occupy an international trade status similar to that of the old destroyers that were sold to England. The value of the tanks and the ships is not nearly as important as the political significance of their transfer. These sales are regarded as initial steps toward much broader moves to aid the British.

Mr. Roosevelt's bold sale of the destroyers, on his own initiative, met with such general approval that in the opinion of some observers, he will be encouraged to go farther yet. Specifically, if the British hold out, they eventually will collide with our Johnson law, forbidding credit to nations in default to us. Pressure will be brought to make a way around the law.

Then, as more of Britain's defense plants are bombed out of action, U. S. sales of munitions and supplies to England will increase, and there will be a demand for more of our war ships to convoy the shipments. The next move would be a call for repeal of our neutrality law, so that our ships could deliver supplies to Britain.

Incidentally, some Army officers admitted that while the old tanks being sold to Canada are too slow and obsolete to meet other tanks in battle, they might be worth their freight to England to serve as "mobile pill boxes." Again incidentally, announcement of the sale to Canada was made by a Congressman, while the War Department had nothing to say officially, which indicates a deplorable lack of team work in the defense program.

Discuss Tin Industry

Congressmen frequently talk "out of turn" these days. They don't like so much autonomous business being done by the Administration, the Defense Commission, etc. This time it's Sen. Warren Barbour (Rep.) of New Jersey. He says a final decision is expected soon on details of a federally-financed tin industry for defense. The Government would aid the setting up of smelters to process Bolivian ore. The matter is being discussed privately by the Defense Commission, RFC, and members of the smelting industry. But officials in other government agencies in charge of metallurgy, meanwhile, say there is no shortage of tin and none in prospect. The price situation is satisfactory too, they say. One of them indicated that Sen. Barbour was trying to get some tin smelters located in New Jersey. Anybody interested in tin will do well to keep a close eye on Washington for a while.

Bankable Contract Plan

Legislation that would permit contractors to assign their claims against the Government to lending agencies as security for loans for plant expansion and equipment, has been approved by the House Judiciary Committee and now goes to a vote before the House. It still has to be passed on by the Senate. This legislation is wanted by the Administration to implement a "bankable contract" plan proposed by the Defense Commission, RFC, and Army and Navy jointly. Under the plan, if and when Congress approves, any contract with the Government for $3.000 or more may be assigned to a federal or private lending agency as security on a loan, to be amortized in five equal annual payments. This procedure, it is expected, will greatly facilitate the defense program by enabling manufacturers to equip themselves to bid on government requirements or to sub-contract to other contractors.

NEW GOVERNMENT PLANT

WASHINGTON — Savage Arms Corp. has agreed to operate a machine gun plant for the government. The plan is to install $17,600,000 worth of government-owned tools in the present Savage plant, after which quantity contracts for production will be awarded to the company. Meanwhile slow progress is being made in getting the 70 or so government - owned private - operated munitions plants underway (the Savage plant is only the fourth), and the list is still being continually modified. The latest change reflects realization that aerial bombardment is becoming a substitute for artillery barrages. Although the number of TNT and smokeless powder plants have been about equal, the present schedule of TNT plants has now been upped from four costing $42,000,000 to perhaps six bigger plants costing something like $100,000,000.

No Curtailment of Merchant Ships

Asked by AMERICAN MACHINIST whether their merchant ship building program might be curtailed for lack of yard space, due to the Navy's huge construction orders, officials of the Maritime Commission said they expected little trouble. They explained that most of their merchantmen building are in yards not engaged in naval construction. In some cases, where commercial and naval buildings are both under way in the same yard, the merchant ships will be finished and no more will be laid down there. The additional load pushed on the commercial yards by Navy expansion will be taken on by construction of additional ways. There are a few World War yards that could be rehabilitated, but in most cases new yards would be cheaper. A few new yards may have to be built. The Commission has been making ready for a shift ever since the big navy program showed on the horizon. Twelve C-3 cargo ships have just been ordered at a cost of $37,000,000 bringing the total of vessels under construction or order by the Commission to 174.

Enigma—Madden's NLRB Job

Presumably the President is approaching prospects who, presumably, are turning down the offer of the Madden hot seat on the Labor Relations Board. Dr. William Leiserson told AMERICAN MACHINIST that he and Edwin S. Smith are functioning as a Board majority, since Madden's term expired August 26. Asked what happens when he and Smith disagree, Dr. Leiserson said, "Nothing happens," and left us to form our own opinion. Asked what he would do if Madden were reappointed, Dr. Leiserson said he couldn't answer. The talk of this town is that FDR is under CIO pressure to reappoint Madden, and that he would do it if the pyrotechnic Mr. Smith would resign, making a spot for a third member who would be sympathetic with the moderate Leiserson. But Smith won't walk the plank. Even if the Board is made moderate by appointments, the NLRB will not function that way until and unless a lot of its subordinate radicals are removed. Nathan Witt, secretary, is one that is tagged to get the axe.

PLANT DRAFT NOT LIKELY

WASHINGTON — The Senate-House conference committee has agreed on the army conscript bill. It is thought by observers here that the amendment allowing seizure of plants by the President was a political gesture which will enable Congressmen to answer constituent complaints against drafting with: "Yes, but we drafted business too." To bear this out the plant draft amendment has since been modified. The President can act now only when danger is imminent and when other sources of supply fail. Plants cannot be seized outright but may be taken and operated on a rental basis.

Military Service For All Will Reduce Machine Tool Production, Say Canadian Industrialists

MONTREAL—Canadian industrialists are greatly opposed to the government's decision to exempt no one between 18 and 35 from compulsory military training. Although 30,000 men in the 21-age group have been called up for the 30-day training period, employers, backed by the government's labor department, vehemently contend that, unless certain exemptions are made, war materials may not be delivered on schedule and the entire wartime industrial program may be thrown out of gear.

Most of the established industries working on war orders, however, are well situated as regards substitutes and reserves of trained men. The companies which are particularly objecting are the newer war industries such as aircraft. Machine tool makers are also objecting strenuously as a shortage of skilled workmen already exists in this industry. The final decision awaits the action of the Prime Minister and his cabinet. They may rescind the order.

Up to the end of August the government had made commitments totaling $165,000,000 for construction of new plants which are scheduled to have an annual productive value of $800,000,000. Canadian government purchases have exceeded $300,000,000, and Canadian purchases for Britain have amounted to $85,000,000, a total of $550,000,000 for the eleven months that Canada had been at war.

More Plants Authorized

This month the government has already authorized the construction of three more plants at a capital commitment of another $17,500,000. The plants, which will be in production next year, include an $8,000,000 chemical plant in Alberta, a $7,000,000 gun plant and a $2,500,000 rifle plant. The chemical plant will be operated by the government owned Allied War Supplies Corp. and the rifle plant will be administered by the newly created government owned Small Arms, Ltd. The gun plant is scheduled to have an annual output of $40,000,000 to $60,000,000. Allied War Supplies Corp. will also administer the previously committed $50,000,000 chemical and explosives plant. Sorel Industries Ltd., established in 1939 to make 25-pounder guns for Britain, has been taken over by the government, which will spend $5,000,000 to equip the plant for the production of naval guns.

Britain continues to give new orders for Canadian Hurricanes. Since the original experimental order for 60 Hurricanes several months ago, Britain has increased the number ordered to 600 at an approximate total cost of $18,000,000.

The following contracts have been awarded recently: Aircraft supplies, Canadian Pratt & Whitney Aircraft Co. Ltd., Longueuil, Que., $169,973; Packard Motor Co., Detroit, Mich., $2,582,087; British Aeroplane Engines Ltd., Windsor, Ont., $34,204. Mechanical transport, Ford Motor Co. of Canada, Ltd., Windsor, Ont., $111,503; Kelsey Wheel Co. Ltd., Windsor, Ont., $25,210. Machinery and tools, T. E. Ryder Machinery Co., Montreal, $13,880; Bausch and Lomb Optical Co., Rochester, N. Y., $157,429. Munitions, Defense Industries, Montreal, $170,386; Dominion Arsenal, Quebec, $569,807.

U. S. Government Contracts Awarded to Metal-Working Firms

(Other Metal-Working Contracts on Page 728j)

Contractor	Gov't Agency	Commodity	Amount
Budd Wheel Co., Detroit, Mich.	War	Projectiles	$1,198,339
American Forge Div. of The American Brake Shoe & Foundry Co., Chicago, Ill.	War	Sheet forgings	624,000
Colt's Patent Fire Arms Mfg. Co., Hartford, Conn.	War	Pistols	56,737
Jackes-Evans Mfg. Co., St. Louis, Mo.	War	Arrestors	32,038
Midvale Co., Philadelphia, Pa.	Navy	Liner forgings	74,740
Crucible Steel Co. of America, New York, N. Y.	Navy	Gun forgings	208,536
Erie Forge Co., Erie, Pa.	Navy	Liner forgings	60,721
Pennsylvania Forge Corp., Philadelphia, Pa.	Navy	Liner forgings	40,118
Bethlehem Steel Co., Bethlehem, Pa.	Navy	Liner forgings	97,162
Crucible Steel Co. of America, New York, N. Y.	Navy	Gun forgings	458,458
Chrysler Airtemp Sales Corp., Dayton, Ohio.	War	Field cabinets	235,000
Parish Pressed Steel Co., Reading, Pa.	War	Field cabinets	278,750
Chase Brass & Copper Co., Inc., Waterbury, Conn.	War	Cartridge cases	1,353,505
American Brass Co., Waterbury, Conn.	War	Cartridge cups	155,353
Yellow Truck & Coach Mfg. Co., Pontiac, Mich.	War	Trucks	15,428,038
Fargo Motor Corp., Detroit, Mich.	War	Trucks	11,650,985
White Motor Co., Cleveland, Ohio.	War	Scout cars	5,412,956
American Car & Foundry Co., New York, N. Y.	War	Light tanks	11,496,951
Mack-International Motor Truck Corp., Washington, D. C.	War	Trucks	66,848
Pennsylvania Forge Corp., Philadelphia, Pa.	Navy	Gun forgings	103,217
Crucible Steel Co. of America, New York, N. Y.	Navy	Gun forgings	882,300
Midvale Co., Philadelphia, Pa.	Navy	Gun forgings	2,282,820
Mergenthaler Linotype Co., Brooklyn, N. Y.	War	Telescope mounts	545,591
National Tube Co., Pittsburgh, Pa.	War	Forgings	52,276
Charles J. Dickgiesser & Co., Derby, Conn.	War	Platform assemblies	36,852
Wm. Scrimgeour, Washington, D. C.	War	Parts for field	60,675
Bethlehem Steel Co., Bethlehem, Pa.	War	Shell	26,344
York Safe & Lock Co., York, Pa.	War	Gun carriages	794,300
Struthers Wells-Titusville Corp., Titusville, Pa.	War	Propeller shafts	82,362
Henney Motor Co., Freeport, Ill.	War	Field ambulances	37,453
Ryan Aeronautical Co., San Diego, Cal.	War	Training airplanes	2,074,234
Beech Aircraft Corp., Wichita, Kansas.	War	Training airplanes	4,847,217
Vultee Aircraft, Inc., Vultee Field, Downey, Calif.	War	Training airplanes	7,488,782
Scovill Mfg. Co., Waterbury, Conn.	Ordnance	Ammunition parts	288,200
J. G. Brill Co., Philadelphia, Pa.	Ordnance	Artillery	148,060
Struthers Wells-Titusville Co, Titusville, Pa.	Ordnance	Forgings	36,078
National Forge & Ordnance Co., Irvine, Warren County, Pa.	Ordnance	Forgings	39,685
Crucible Steel Co. of America, New York, N. Y.	Ordnance	Forgings	40,587
Barnard Aviation Equipment Co., Inc., Ashley, Pa.	Ordnance	Fire control equipment	90,898
Bell & Howell Co., Chicago, Ill.	Ordnance	Fire control equipment	322,512
Saginaw Stamp & Tool Co., Saginaw, Mich.	Ordnance	Trailers	234,562
American Car and Foundry Co., New York, N. Y.	War	Ammunition	39,200
Peco Mfg. Corp., Philadelphia	War	Forgings machining	295,000
Lansdowne Steel & Iron Co., Morton, Pa.	War	Shell forgings	133,518
Aluminum Co. of America, Cleveland, Ohio.	Navy	Forgings	20,690
Bethlehem Steel Co., Bethlehem, Pa.	Navy	Forgings	35,354
General Drop Forge Co., Inc., Buffalo, N. Y.	Navy	Forgings	20,017
Morton Mfg. Co., Muskegon Heights, Mich.	Navy	Propeller and profiling machines	113,000
General Electric Co., Schenectady, N. Y.	War	Electrical equipment	61,560
Beech Aircraft Corp., Wichita, Kans.	War	Airplanes	3,510,746
Livingston Shipbuilding Co., Orange, Tex.	Navy	Surf landing boats	118,824

INSIDE DETROIT

Ford will build Pratt & Whitney engines at the rate of almost one per hour; to save time Ford also will build many of the machine tools required. Chevrolet plans for 1,100,000 cars

BY RUPERT LE GRAND, DETROIT EDITOR

DETROIT—In connection with its program to produce Pratt & Whitney engines for the government, Ford has already broken ground for a two-story 600,000 sq. ft. plant adjacent to the huge tool and die plant in the Rouge. Construction will be completed within 100 days, and the plant may produce motors within eight months. To save tooling-up time, the Ford toolroom will build many of the machine-tools required. Since many of the engine parts will be small, the Ford-built equipment will be of miniature size such as now in use at the Willow Run lock plant and the plastics department in the Rubber plant.

Ford officials believe that they can produce fifteen Pratt & Whitney engines in two shifts, or practically one per hour.

The Ford twelve-cylinder liquid-cooled aviation motor may soon reach the tooling-up stage. A high official stated that: (1) tooling up for a projected new plant in the Rouge may soon commence, (2) motors will probably be in production within a year to eighteen months, (3) the plant will be equipped to produce Ford aircraft motors in larger volume than the Pratt & Whitney undertaking, (4) Ford will go ahead with these plans although the motor has not been approved by the Army, and Air Corps tests can not normally be completed in less than a year, (5) the liquid-cooled motor is strictly a Ford design which will be manufactured along proved Ford engine building practices, (6) no attempt has been made to copy the Rolls-Royce or Hispano-Suiza designs, and (7) the Highland Park plant is unsuitable for aviation-engine production because of the problems involved in trucking materials and parts fabricated in Rouge primary producing divisions.

Chevrolet Is Conservative

Press previews of 1941 models are over, and most makes will be seen by the public before the end of September. Chevrolet showed 1941 lines with marked style advances and longer wheelbase to newspapermen on Sept. 10, and has scheduled the public announcement for Sept. 21. A goal of 1,100,000 units for 1941 has been announced by Chevrolet, which certainly is a conservative statement in view of the fact that many were produced in 1940, and Alfred Sloan predicts a 10-20 per cent gain for the industry.

Ford's preview was more elaborate than in recent years. On Sept. 11, 200 preview guests were taken from Detroit to the River Rouge dock on chartered boats, then transferred to seat-equipped railway flat cars and hauled through the Rouge plant in comfort. Besides a novel view of manufacturing operations, newspapermen were made acquainted with the possibilities of the Ford plant in national defense. Chrysler, which has concentrated its major styling and mechanical changes in Dodge, DeSoto and Chrysler cars, previewed those lines on Sept. 12. The Chryslers will be announced this weekend. Packard wound up the season by showing its new models at its proving grounds at Utica, Mich.

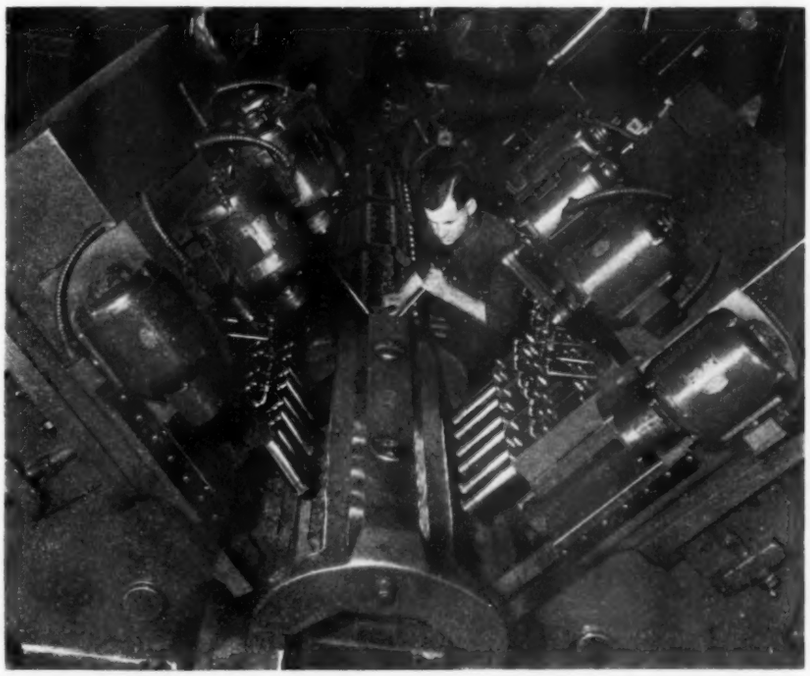
Ford Six Dropped

Ford products, as reported previously, represent continued evolution of the body design principles utilized by that manufacturer in the past few years, but the 1941 models can be called new, not merely revised. The Ford will be offered in two series, deluxe and super deluxe. Both will be powered with the 85 hp. V-8 engine The six-cylinder engine is definitely "out." And the Ford will not be offered with an option of the 95 hp. V-8 engine.

Ford bodies have been widened as much as 7 in. While a narrow runningboard is still visible, the actual body width closely approximates that associated with the Torpedo design, although Ford will definitely not follow the Torpedo trend. Glass area has been increased about four square feet. An exceptionally large curved rear window follows the body contour. Longer wheelbase and improvements in springing and shock absorbers promote an improved ride.

NEW PARTS FOR FENDERS

DETROIT—Front fenders with replaceable elements will be featured on at least two lines for 1941. As seen on Oldsmobile, the lower half of the fender, from the center of the lamphouse to the rear skirt, consists of two stampings bolted to the upper half, and with the horizontal joint concealed by a chromium-plated molding. Ford is expected to use the same principle. Fenders have become such deep-drawn, massive affairs that manufacturers evidently are trying to save die cost, besides giving the motorists a break when jitterbug drivers crumple expensive sheet metal.



Mechanical Giant—*Is the automatic boring apparatus used in machining the Lincoln-Zephyr engine block. In one swift operation this machine establishes simultaneously the 75-degree angle for all 12cylinders of the V-type engine. It is accurate to within 1/1,000 of an inch*

The Mercury will also be wider and longer, have improved springing and shock absorber control, but will again be powered with the 95 hp. V-8 engine. Faster acceleration is obtained through an improved transmission. Six body types, including a new coupe and a station wagon, will be offered in the Mercury line.

The Lincoln Zephyr will be built in four body types—sedan, coupe, 6-passenger club coupe, and a convertible coupe. Four color options will be offered in upholstery and trim. Door latches are push-button operated. The Lincoln Continental model, first introduced last year, will include the former cabriolet and a new coupe. To top the line, Lincoln will have 138 in. wheelbase custom 8-passenger sedans and limousines with exceptional roominess. This car is built in the unit body and frame construction evolved for the Zephyr. Luxury refinements such as hydraulic window lifts will be featured.

Approximately 60 refinements and improvements will be found in the Ford, Mercury, Lincoln-Zephyr and Lincoln Continental and custom lines. A new high note is struck in luxurious appointments and interior color harmony. Plastics play a large part in decorative effects achieved in the interior, while a greater amount of rustless steel and chromium plated moldings embellish the exterior.

New Airflow Chrysler

From 1934 to 1937 Chrysler built the Airflow and it has since greatly influenced automobile body design. Always proud of the original Airflow, Chrysler is now ready to announce a new Airflow line, which is a notable advance over its namesake. The 1941 cars are wider, as much as 7½ in. longer, and 1½ in. lower than last year. Much of the additional roominess has been achieved below the window line. The body bells at this point, giving rise to the term "space-flared." Thus, the edge of the front seat is approximately five feet wide, or greater than the original Airflow.

Chrysler offers four lines for 1941 in 26 models—the Royal and Windsor sixes, the New Yorker and Crown in 26 models—the Royal and Windsor models measure 210 in. over-all, are powered with a larger 112 hp. "Spitfire" engine.

Mechanical improvements include a multiple-jet carburetor to increase horsepower and economy and a new type of thin-babbitt main and crankshaft bearings claimed to increase bearing life up to 500 per cent. The frame, said to be the strongest and most rigid ever used in a Chrysler car, is a double channel type, two U-shaped girders being welded together to form the side rail. This construction permits omission of the X-member. The front cross member is a box section, welded and riveted to side rails.

Crowell Reelected President of Army Ordnance Association

WASHINGTON—Brig. Gen. Benedict Crowell, special consultant to Secretary of War Henry L. Stimson, has been reelected president of the Army Ordnance Association. Gen. Crowell was a founder of the association twenty-one years ago and has served as its president continuously since. He was Director of Munitions in the World War Cabinet of President Wilson and was the Assistant Secretary of War under Newton D. Baker. General Crowell is president of the Central National Bank of Cleveland.

Elected vice-presidents of the association were Col. William W. Coleman, chairman, Bucyrus-Erie Company, Milwaukee, formerly special assistant to the Chief of Ordnance, U. S. Army; and Col. Frederick H. Payne of Greenfield, Mass., Assistant Secretary of War under President Hoover and now chief of the Hartford (Conn.) Ordnance District.

Elected directors of the association were Col. Frank A. Scott of Cleveland, first chairman of the General Munitions Board and organizer of the War Industries Board in the World War; Colonel Robert P. Lamont, New York, Secretary of Commerce under President Hoover; and Col. James L. Walsh, New York, consulting engineer, first secretary of the Association and founder of its journal.

BENEDICT CROWELL

U. S. Government Contracts Awarded to Tool Makers

(Defense Contracts on Page 728h)

Contractor	Gov't Agency	Commodity	Amount
Dana Tool D-Nast Machinery Co., Philadelphia, Pa.	Navy	Taps, dies	$21,722
Lodge & Shipley Machine Tool Co., Cincinnati, Ohio	Navy	Engine lathes	19,043
Harris-Seybold-Potter Co., Cleveland, Ohio	War	Turning machine	15,000
Wisconsin Axle Div., Timken-Detroit Axle Co., Oshkosh, Wis	War	Transmission parts	26,448
The Bullard Co., Bridgeport, Conn	War	Boring mills	136,614
E. L. Easley Machinery Co., Chicago, Ill	War	Metal working	17,822
Marshall & Huschart Machinery Co. Chicago, Ill	War	Boring machines	204,329
Cincinnati Milling Machine & Cincinnati Grinders Inc., Cincinnati, Ohio	War	Grinding machines	17,003
Brown & Sharpe Mfg. Co., Providence, R. I.	War	Grinding machines	25,251
Kearney & Trecker Corp., Milwaukee, Wis.	War	Milling machines	15,680
Pratt & Whitney Div. Niles-Bement-Pont Co., West Hartford, Conn	Navy	Drilling machines	38,008
Robbins & Myers Inc., Springfield, Ohio	Navy	Hoists	12,627
The Ajax Mfg. Co., Cleveland, Ohio	Navy	Bolt & rivet machines	21,768
Sebastian Lathe Co., Cincinnati, Ohio	WPA	Lathes	23,200
Lloyd & Arms Inc., Philadelphia, Pa	War	Drilling machine	10,340
Henry Prentiss & Co., Inc., Boston, Mass.	War	Radial drills	76,134
Stedfast & Roulston Inc., Boston, Mass	War	Engine lathes	19,288
Gisholt Machine Co., Madison, Wis	War	Turret lathes	29,316
Harnischfeger Corp., Milwaukee, Wis	War	Bridge crane	22,625
Waterbury Farrel Foundry & Machine Co., Waterbury, Conn	War	Cartridge gaging machines	30,000
Austin-Hastings Co., Inc., Cambridge, Mass.	War	Hydraulic planer	35,712
Kearney & Trecker Corp., Milwaukee, Wis.	Navy	Milling machines	57,968
Reed-Prentice Corp., Worcester, Mass	Navy	Lathes	111,670
Thompson Grinder Co., Springfield, Ohio	Ordnance	Grinding machines	46,200
Pheoll Mfg. Co., Chicago, Ill	Navy	Screws and nuts	64,985
Warner & Swasey Co., Cleveland, Ohio	Navy	Turret lathes	10,274
Wm. Sellers & Co., Inc., Philadelphia, Pa.	Navy	Boring machines	36,428
The Bullard Co., Bridgeport, Conn	Navy	Turret lathes	15,525
Wm. Sellers & Co., Inc., Philadelphia, Pa.	Navy	Planers	156,220
Niles-Bement-Pond Co., Div. Pratt & Whitney, East Hartford, Conn	War	Milling machines	31,488
Chambersburg Engineering Co., Chambersburg, Pa	War	Power hammers	14,600
Henry Prentiss & Co., Inc., New York, N. Y.	War	Grinding machines	13,986
Edward A. Lynch Machinery Co., Philadelphia, Pa	Navy	Drilling machines	17,065
Niles-Bement-Pond Co., Pratt & Whitney Div., Hartford, Conn	War	Die sinking machines	38,564
Thompson Grinder Co., Springfield, Ohio	War	Grinding machines	46,200
Kearney & Trecker Corp., Milwaukee, Wis.	Navy	Milling machines	29,002
Lapointe Machine Tool Co., Hudson, Mass.	War	Broaching equipment	73,657
Davenport Machine Tool Co., Inc., Rochester, N. Y.	War	Screw machines	34,863
William Sellers & Co., Inc., Philadelphia, Pa.	Navy	Drilling machine	35,805
Marshall & Huschart Machinery Co. of Indiana, Indianapolis, Ind	WPA	Milling machines	30,782

NAMES in the NEWS

K. T. Keller, president of the Chrysler Corp., became chief executive of the corporation as the Board of Directors voted to discontinue the office of chairman of the board. Mr. Keller had been president for two years since Walter Chrysler became ill in 1938. Herman L. Weckler, vice-president and general manager, was elected to the board to fill the vacancy.

William S. Knudsen, president, General Motors Corp., has tendered his resignation as president in order to devote himself completely to his governmental duties as a member of the National Defense Advisory Commission. Mr. Knudsen had been on leave of absence from General Motors since June 1, 1940.

C. L. McCuen, vice-president, was elected a member of the Administration Committee, and Harley J. Earl, director of the corporation's styling section, was elected a vice-president.

J. F. Brown, formerly chief engineer of South Works, has been appointed construction engineer for the Chicago District of the Carnegie Illinois Steel Corp. A. J. Hulse has been named to succeed Mr. Brown as chief engineer. Mr. Brown was first employed at South Works in 1904 in the civil engineering department. Mr. Hulse entered the service of the corporation in 1936 as assistant chief engineer at South Works.

Celebrates 65th Anniversary

HARRY WILSON, SR.

Harry Wilson, Sr., who is a timekeeper at Jessop Steel Co., Washington, Pa., is now celebrating his 65th year of combined service with the company, and its one-time parent concern, Jessop of Sheffield. Mr. Wilson is the fourth direct descendant of Wilsons who have worked continuously for Jessop from 1774 to the present time, and is the father and grandfather of four Wilsons now employed by the American Jessop.

New Board Member

HERMAN L. WECKLER

Charles L. Clarke was made superintendent of yards and transportation. He has been employed at South works since 1896 when he began as a switchman. Howard C. Brown has been named assistant superintendent of yards and transportation to succeed Mr. Clarke.

Roy Hunter and P. Robert Foseid have been named to the sales force of Gisholt Machine Co., Madison, Wis. Both men will handle the complete line of Gisholt turret lathes, automatic lathes and balancing machines. Mr. Hunter will be in charge of the Cleveland office, while Mr. Forseid will make his headquarters at Philadelphia.

George A. Mohr has been elected secretary of the Boye & Emmes Machine Tool Co. of Cincinnati, Ohio.

George M. Class, formerly chief engineer of the Gisholt Machine Co., of Madison, Wis., has recently been elevated to the post of vice-president in charge of engineering. Mr. Class has been a member of the Gisholt organization for 16 years.

Milton P. Higgins, resident manager of the Electric Furnace plant of the Norton Co. at Chippawa, Ont., for the past two years, has been transferred to the Worcester headquarters as assistant manager.

S. P. Broome, special representative of the Crucible Steel Co. of America, has been appointed to cooperate with the National Defense Advisory Commission. Mr. Broome will conduct liaison work between the company and the Commission.

Warner G. Tilsher has been appointed Factory Manager of the Taylor-Winfield Corp. Mr. Tilsher has been active in the development and manufacture of aircraft, streamline trains and other light weight structures. In 1931 he designed the first airplane completely fabricated by spot welding.

Chief Executive

K. T. KELLER

C. W. Sweeney has been named in charge of the Bunting Brass & Bronze Company's operations on the Pacific Coast.

Carl H. Youngdahl has been appointed assistant superintendent of the power production division of Carnegie-Illinois Steel Corporation. He has served as division engineer in charge of operation, maintenance and construction since 1928. Russell W. Davy, who succeeds Mr. Youngdahl, received the post of construction engineer after serving in various capacities in the Civil Engineering Department.

BUSINESS ITEMS

L & J Press Corp. is taking over the business of the Loshbough-Jordan Tool & Machine Co., Elkhart, Ind. The business consists of the manufacture and sale of the L & J Punch Presses.

Sterling Pump Corp., Hamilton, Ohio, has purchased the turbine pump business of Roots-Connersville Blower Corp. of Connersville, Ind. Sterling will manufacture and sell this line of pumps in the future under their name.

Reliance Electric & Engineering Co., Cleveland, Ohio, has opened a sales office in Houston, Texas. Frank A. Denison, Jr., has been appointed district manager.

Carnegie-Illinois Steel Corp. has reached a settlement with the Cold Metal Process Co. concerning patent

Liaison Officer

S. P. BROOME

Factory Manager

WARNER G. TILSHER

litigation which involved the so-called Steckel patents for equipment and processes for rolling in the cold reduction of steel products. By the agreement Carnegie and other subsidiaries of the United States Steel Corp. are licensed to operate under the patents for royalties set out in the settlement.

W. A. Schofield has been appointed Michigan representative of the Metal Carbides Corp., Youngstown, Ohio.

Stanley W. Sparks and C. Nelson Sparks have organized the Sparks-Simplex Machinery Corp., Norwalk, Conn.

Patents for the manufacture of steel by the Bessemer Flame Control process have been granted Jones & Laughlin Steel Corp., Pittsburgh, Pa. Patent applications covering Bessemer Flame Control have also been filed in many foreign countries.

Liberty Planer & Mfg. Co., Hamilton, Ohio, has been formed to succeed the Liberty Machine Tool Co. The new company will manufacture the complete line of Liberty double housing, open side and convertible planers. Harry A. Dingeldein and H. R. Ryan have been named president and vice-president respectively of the new organization.

PLANT EXPANSION

Grumman Aircraft Engineering Corp., is planning a new factory building which will cost between $1,000,000 and $1,500,000.

Glenn L. Martin Co., Baltimore, Md., has launched the first of a series of factory additions which is expected to bring its total floor space to around 3,000,000 sq. ft. A huge expansion of the Middle River group will immediately add nearly 400,000 sq. ft. to the present 1,263,000 financed with the company's own funds.

Chain Belt Co., Milwaukee, Wis., is planning to erect a two-story addition to its plant.

Cincinnati Bickford Tool Co., has filed plans for a plant addition to cost $140,000.

Jacobs Mfg. Co., Hartford, Conn., has begun construction of its new $350,000 plant in Elmwood, Conn.

OBITUARIES

Gus F. Liden, 62, president and general manager of the Liden Mfg. Co., Lansing, Mich., died recently following an illness of two months. Mr. Liden was connected with the Lindell Drop Forging Co. until 1928 when he organized the Liden Mfg. Co.

Robert Thomas Walsh, superintendent of the Pequonnock Foundry, Bridgeport, Conn., died last month.

Dr. Lester P. Breckenridge, 83, Professor Emeritus of Mechanical Engineering at Yale University, died recently. Dr. Breckenridge was at one time vice-president of the American Society of Mechanical Engineers, a former vice-president of the Western Society of Engineers, Chairman of the Super-Power Survey in 1920, and a member of the World Power Conference.

George C. Newell, Brown & Sharpe employee for over 35 years, died recently after a brief illness. Mr. Newell who was in the Screw Machine Mfg. Dept. when he joined the organization in 1905, had assumed the duties of supervising purchasing of plant equipment in 1939, which position he held at the time of his death.

Walter C. Marmon, 68, a pioneer automobile manufacturer, died recently. Mr. Marmon was formerly chairman of the board of the Marmon-Harrington Co., manufacturers of trucks and tractors since 1931.

John Penton, 78, chairman of the board of the Penton Publishing Co. died at his home in California last week. Mr. Penton started publication of The Foundry in 1892. He organized the Iron and Steel Press Co. in 1901. It became the Penton Publishing Co. in 1904, and published Steel and other iron and steel trade publications.

MEETINGS

American Gas Association. Annual Convention. Atlantic City, N. J. Week of Oct. 7.

National Metal Exposition, Cleveland, Ohio. Cleveland Public Auditorium. Oct. 21-25.

American Society of Mechanical Engineers. Fall Meeting. Spokane, Wash. Sept. 3-6.

National Association of Foremen. Annual Convention. Hotel Gibson, Cincinnati, Ohio. Sept. 26-29.

National Safety Congress and Exposition. Stevens Hotel, Chicago, Ill. Oct. 7-11.

Society of Automotive Engineers. National Aircraft Production Meeting. Hotel Biltmore, Los Angeles, Calif. Oct. 31-Nov. 2.

American Society for Metals. Annual convention. Hotel Statler, Cleveland, Ohio. Oct. 21-25.

American Welding Society. Annual convention. Hotel Cleveland, Cleveland, Ohio. Oct. 20-25.

The Wire Association. Annual convention. Carter Hotel, Cleveland, Ohio. Oct. 17-23.

American Society of Tool Engineers. Semi-annual convention. Cincinnati, Ohio. Oct. 17-19.

American Gear Manufacturers Association. The 23rd semi-annual convention, Skytop Lodge, Syktop, Pa. October 14, 15 and 16, 1940.

Society of Automotive Engineers. National tractor meeting, Schroeder Hotel, Milwaukee, Wis., Sept. 24-25. Annual dinner, Hotel Commodore, New York, N. Y., Oct. 14.

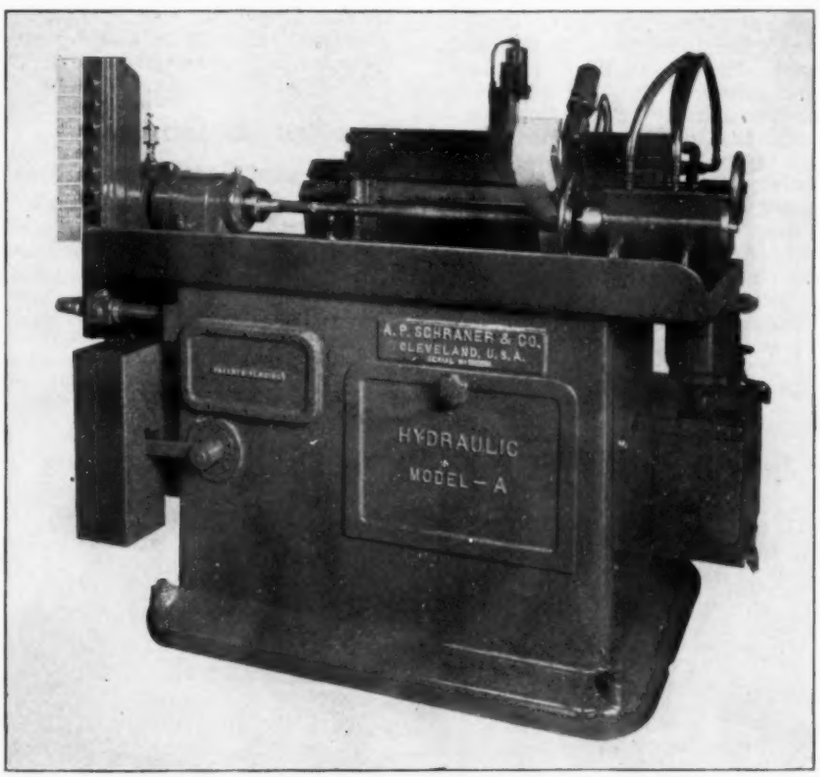
SHOP EQUIPMENT NEWS

Improved External Cylindrical Lapping Machine Permits Quick Change of Operating Set-Ups

An improved design of its Model A lapping machine, incorporating simple and convenient adjustments to permit quick changeover to various types of work, has been made available by A. P. Schraner & Co., Payne Ave. & E. 33rd St., Cleveland, Ohio. This machine is suitable for lapping external cylindrical surfaces on straight shafts, crankshafts, and plain bearings on many parts used in automotive, aircraft, machine tool and other industries.

Machine consists of a welded steel base of box construction. This base contains the hydraulic pump, piping, valves, clutch and electrical control panel. Headstock and tailstock are mounted in the pan, the tailstock being adjustable laterally to accommodate different lengths of work. Headstock spindle is oscillated laterally with about ⅛-in. movement by a back geared drive to the cam. Tailstock has a spring center. A cross rail, mounted at the rear of the base, carries the lapping heads. These heads are adjustable laterally and are arranged to take interchangeable lapping shoes for various sizes of work. Machine is fully hydraulic, with solenoid operated clutch and valves, and is equipped with pushbutton control. Main drive motor, as well as the coolant sump, pump and filter arrangement, is mounted on the base at the rear.

Paper or cloth abrasive of suitable grit is carried on spools at the front of each lapping head. For each piece to be lapped the required amount of fresh abrasive is automatically fed into the lapping shoes and the used abrasive removed, thereby providing identical conditions for continuous production. A production rate of from 150 to 250 pieces per hour can be obtained, depending on the type of job. Finish obtainable is of the order of 2 to 3 micro-inches.



Vertical Spindle Disk Grinder Made Available by Hanchett

Hanchett Mfg. Co., Big Rapids, Mich., has developed a new vertical spindle disk grinder. Identified as the No. 153, this machine employs a grinding disk 1 in. thick, which is made up in

eight sections. These sections are attached to a steel plate by means of filister head screws passing through openings in the abrasive, which is vulcanized to thin steel plates. The steel disk plate is attached to a wheel flange 34 in. in diameter and 4 in. thick.

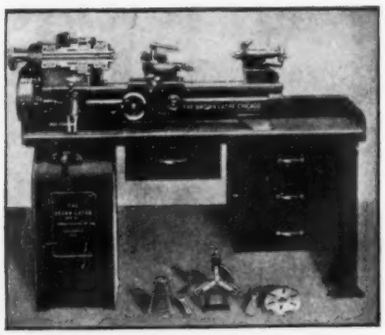
Wheel spindle is mounted in preloaded precision ball bearings and is driven through V-belts by a 25-hp. vertical motor located within the machine base. Spindle speed is 435 r.p.m. Grinder can be arranged for wet grinding, if desired.

A rugged oscillating type of wheel dresser is built into the machine. Passing from the outside of the disk to the center, it makes it easy to maintain a true grinding surface at all times. Wheel dresser arm is entirely clear of the machine while work is being ground. Openings beneath the grinding disks are provided for attachment to the dust exhaust system. Approximate weight of the machine is 7,500 lb.

Brown Precision Bench Lathe Has Quick-Change Belt Drive

The Model SP 9-in. swing underneath drive bench lathe made by Brown Machine Co., 14–16 N. May St., Chicago, Ill., is suitable for screw cutting and other precision operations. Mounted on a steel cabinet bench, this lathe as illustrated is provided with a headstock having a 1-in. collet capacity spindle mounted on two large double Timken bearings. With this construction, it is possible to take heavy cuts without chattering.

Steel cabinet bench is of all-welded construction and has three drawers



on one side and one in the middle. Automatic belt shifter shifts belt on three-step pulley without the necessity of first slackening it. Change gears are furnished to give a thread-cutting range of 4 to 40 threads per inch.

With a countershaft speed of 255 r.p.m., spindle speeds of 38, 61, 102, 208, 334 and 565 r.p.m. are possible. Bed lengths of 36, 42, 48 and 60 in. provide center distances of 16, 22, 28 and 40 in. Approximate shipping weights are 800, 825, 850 and 900 lb.

Special Broaching Machine Finishes Half-Round Holes In Various Sizes of Parts Without Tooling Changeover

American Broach & Machine Co., Div. of Sundstrand Machine Tool Co., Ann Arbor, Mich., has developed a special broaching machine to finish broach the half-round slots in differential cases of various sizes. Machine employs the surface broaching principle, having four stations, with two fixtures at each station.

A permanent tooling set-up is made possible with two fixture stations on each side of the machine. Any one of four differential case halves making up two separate differential case assemblies can be finished without any tooling changeover.

Machine itself, identified as the Model 4HC-18 horizontal broaching machine, comprises a fabricated base containing the oil reservoir, coolant reservoir, coolant pump, hydraulic pumping unit, valving and motor. An inclined trough conveys chips to one corner of the base where they are conveniently removed. Four machine slide units are provided, one on each of the four sides. All four cylinders are connected to the hydraulic pump unit, with the design such that any one side of the machine may be operated independently and two adjacent sides operated simultaneously by two different operators. Separate machine control is provided for each cylinder slide assembly.

Specifications: normal capacity, 4 tons, each cylinder; cylinder diameter, 5 in.; broaching speed, 18 ft. per min.; return speed, 28 ft. per min.; cylinder stroke, 18 in.; over-all height, 50 in.; net weight with tooling, 10,000 lb.; and operating space required, 14x14 ft.

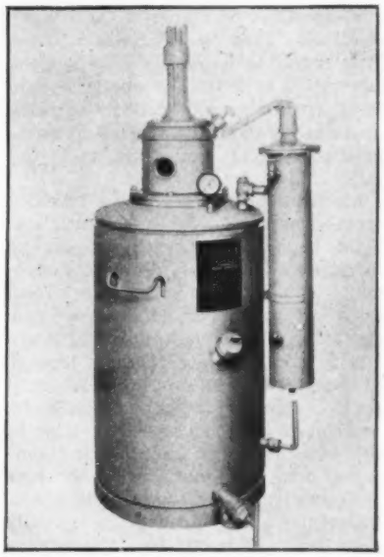
Portable Acetylene Generators Available in Four Capacities

Marquette Mfg. Co., Minneapolis, Minn., has made available four portable acetylene generators ranging in capacity from 12 to 50 lb. In addition to economy of operation, these generators offer the advantages of small size and convenient handling.

Operation is said to be very simple. Filling is accomplished easily by loosening four wing nuts, lifting the hopper from the generator and placing it bottom side up on the floor. Carbide is added through the opening provided. Twelve gallons of water are then placed in the main tank. Hopper can then be replaced and tightened down and the generator is ready for service. Charging is begun by lifting the handwheel at the top of the hopper. Charging rate can be adjusted by turning the wheel. Generator is entirely automatic thereafter. An observation window permits the quantity of remaining carbide to be noted.

Safety features include an interlocking bar to insure that no pressure exists in the generator before removing the carbide filler cap, a water seal tank to wash the acetylene and act as a hydraulic safety valve in the case of backfire, and a flash-back valve and blow-off valve.

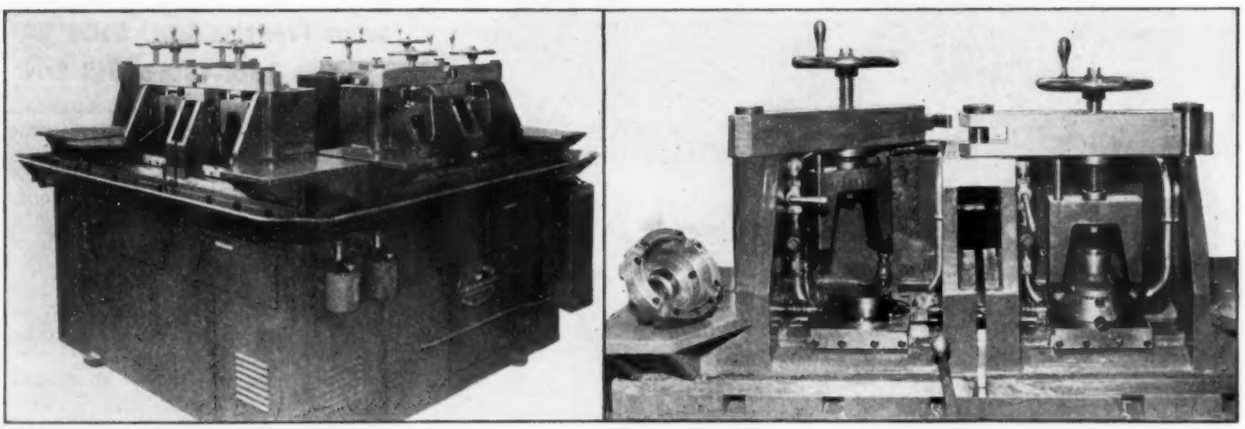
The No. 512 model holds 12 lb. of carbide and 12 gal. of water, stands 40 in. high, weighs 95 lb. and produces 24 cu.ft. per hr. The No. 515 holds 15 lb. of carbide, 17 gal. of water, stands 50 in. high, weighs 96 lb. and delivers 30 cu.ft. per hr. The No. 530 holds 30 lb. of carbide and 33 gal. of water, stands 61 in. high, weighs 123 lb., and produces 60 cu.ft.



per hr. The No. 550 holds 50 lb. of carbide, 55 gal. of water, stands 69 in. high, weighs 177 lb. and delivers up to 100 cu.ft. of acetylene per hr.

Boice-Crane Expands Line of "Helmet-Head" Drill Presses

Boice-Crane Co., 1730 Norwood Ave., Toledo, Ohio, has added several new models to its "Helmet-Head" line of drill presses with completely inclosed drives. Additional models include single and multiple spindle floor



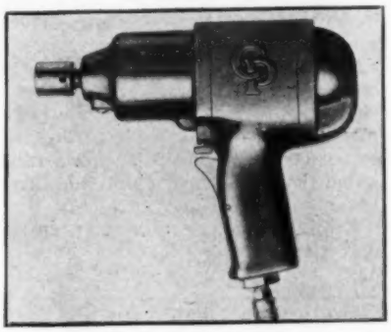
types, Morse taper spindle types, and an extensive range of slow-speed models having five speeds from 425 to 3,340 r.p.m. in both single and multiple bench and floor types.

Also added to the "Helmet-Head" line are several new high speed tapping machines. Separate drill press heads, columns and column flanges have also been made available for building up low-cost special drilling, reaming and tapping tools.

Chicago Pneumatic Wrenches Employ "Power-Vane" Motors

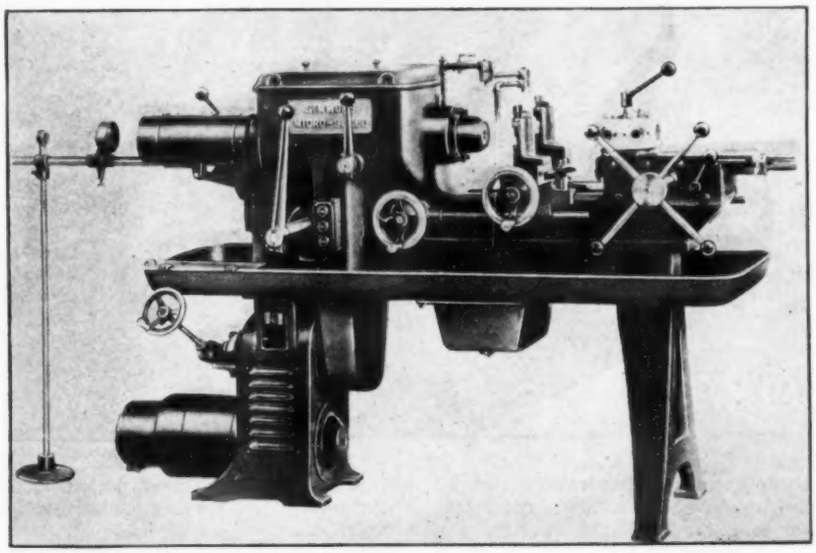
A line of reversible pneumatic wrenches developed by Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y., employs a slow speed "Power-Vane" rotary motor which is simple in design, efficient in operation and economical in maintenance. These wrenches have no gears or resilient members in the driving unit.

Light in weight and having a short



over-all length, these tools are said to be extremely easy to handle. Three models, the Nos. 344-R, 349-R and 360-R, handle bolts of ⅜, ⅝ and ¾ in. respectively.

Maximum Production from Simmons Screw Machine Promoted by Built-In "Micro-Speed" Spindle Drive



An unusual advantage is claimed for the No. 2 turret screw machine offered by Simmons Machine Tool Corp., Albany, N. Y., in the "Micro-Speed" drive unit which provides 1,000 spindle speeds at the twist of a handwheel. Built into the machine base, this unit enables the operator immediately to select the best spindle speed for the stock being machined.

Designed for rapid production, this machine has a spindle mounted on Timken tapered roller bearings and has all bearings for sliding members accurately hand scraped. Head is cast solid with the bed to insure greatest rigidity. Turret is provided with six tool holes, arranged to hold tools with or without shanks.

All levers are within convenient reach of the operator. On the headstock is a long lever for operating automatic chuck and bar feed, giving maximum leverage for closing collets. Cut-off is operated by a lever, although screw feed can be furnished.

Specifications: swing over bed, 14 in.; swing over cross slide, 6 in.; automatic chuck capacity—round, 1 in., square, 1⅛ in., hexagon, ⅞ in. Hole in plunger is 1 1/32 in. in diameter; that through the spindle is 1¼ in. Net weight of the machine is 1,600 lb.

Faster Stamping Possible With Double-Floating Safety Holder

A double-floating box-type safety holder offered by M. E. Cunningham Co., 115–117 E. Carson St., Pittsburgh, Pa., has been developed for faster and more efficient marking on hot, cold, flat, round, or angular surfaces. This holder is said to work equally well whether the surface is rough sheared, sawed or ground.

Holder is constructed with a sleeve

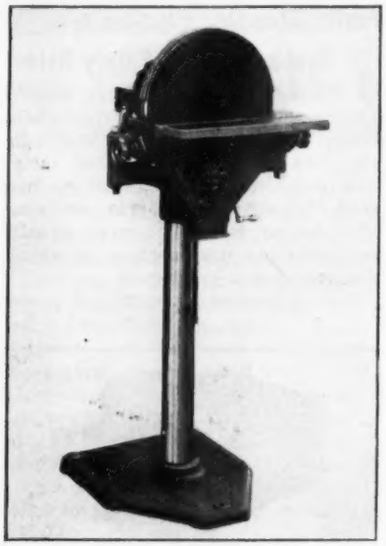
which levels or holds the floating type holder at right angles on the surface to be marked. Steel type also floats within the type holder. Because both holder and type are held loosely, a double leveling action takes place when the holder is struck with a hammer. Leveling sleeve prevents holder from tipping over when in use, and at the same time prevents pieces from flying in case one of the stamps should break or chip from misuse. Holder and type are made from patented safety steel which will not spall or mushroom.

Max 16-in. Disk Sander Suitable for Aircraft Work

The 16-in. universal floor model disk sander developed by Max Mfg. Co., 735 The Alameda, San Jose, Calif., has proved of particular value to the aircraft industry. Capable of surfacing wood, metal, plastics and

other materials quickly and accurately, this sander is simple in design and sturdy in construction.

Working unit is mounted on top of a ground steel column which is pressed into a cast iron base. Table assembly is attached to a worm gear mechanism which permits raising or lowering the table as required to any desired height. Table size is 9½x18 in. and is provided with trunnions and



locks at each end. It can be set quickly by a large protractor and locked at any angle from 45 deg. up to 45 deg. down. A positive 90 deg. stop permits rapid repositioning of the work table.

The sander is regularly equipped with a ½ hp. ball bearing repulsion induction motor for either 110 or 220 volts. The machine is also available as a bench model.

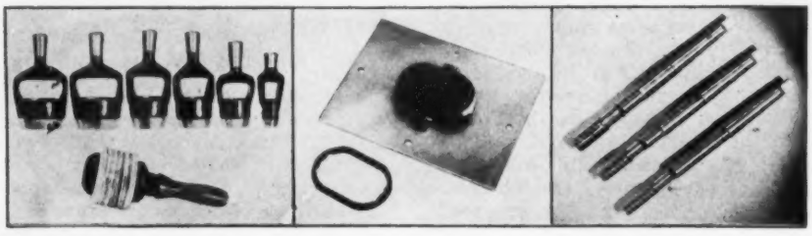
Hand Forged Steel Punches Made Available by Bates

Hand forged steel punches, for both hand and machine use, have been made available by H. O. Bates, 251–257 N. Broad St., Elizabeth, N. J.

Left-hand photograph illustrates several sizes of round hand forged punches and a rawhide mallet used with them. These punches can be furnished for cutting any practical shape or design. Mallet is made of rawhide washers clamped tightly in a cast iron handle, and is furnished in several weights to suit particular types of hand punching requirements.

Center photograph shows hand forged press punches which have been developed to supplant steel rule dies. These press dies are forged to any practical shape from wear resisting tool steel, and after hardening are mounted on a steel backing plate for use in a foot or power press. Dies can be detached for sharpening.

Illustration at the right shows a high speed rotary punch for cutting round holes in resilient rubber or other pliable materials. By tapering the cutting edge properly, accurate and clean holes can be cut with ease.

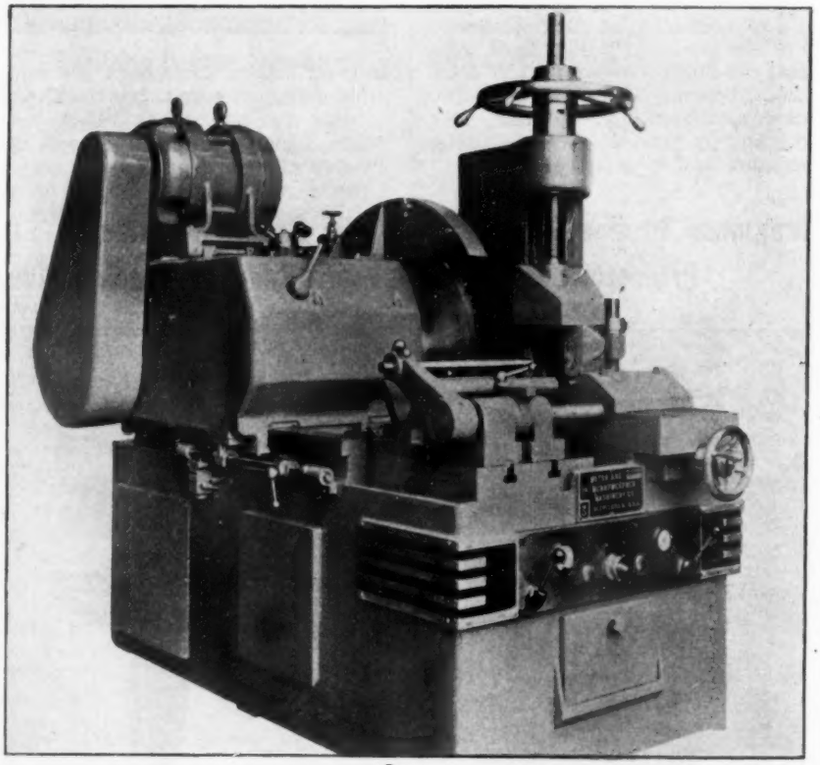


Motch & Merryweather Hydraulic Cold Sawing Machine Intended for Heavy Duty Service

Motch & Merryweather Machinery Co., W. Third & Lakeside Ave., Cleveland, Ohio, has developed a hydraulic cold sawing machine designed to withstand the severest service. Identified as the No. 3 cold saw, this machine features a saw carriage of extremely rugged construction, nine speed changes, hydraulic feed and automatic lubrication.

Saw carriage contains the entire drive to the saw blade. A built-in pump provides lubrication for all bearings and gears. Main drive motor is mounted on this carriage and is connected to the drive pulley by multiple V-belts. Saw rotation is controlled through a multiple disk clutch and brake running in oil operated from the front of the machine.

Nine speed changes in geometrical progression are provided, ranging from 18 to 134 ft. per min. Speed change gears are of the spur type, sliding on hardened and ground multiple-spline shafts mounted on Timken bearings. Gearing in the final drive train is helical with exceptionally wide face.



Base is of box construction, and includes a cutting compound reservoir as well as an oil reservoir. Hydraulic unit and control valves are in a separate compartment. Hydraulic feed provides a stepless variable feed and quick return. System is of the low pressure type. Vane hydraulic pump is direct driven. Motor pump and control valves form an integral unit inserted in the bed. In this unit are two adjustable valves, one of which limits the total feed pressure to the saw carriage, while the second insures that the work is clamped prior to feeding the carriage. Thus the saw

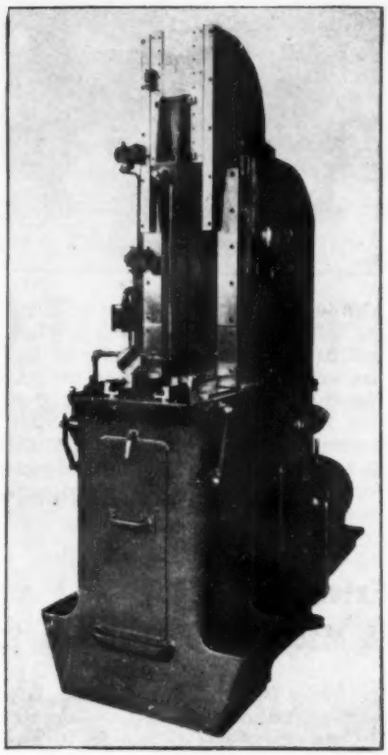
blade is protected independently of the rate of feed.

Controls are centralized on a panel at the front. Two handles control the motion of the saw carriage and that of the vertical vise jaw. Other features include: pressure gage to measure feed and clamping pressures, ammeter to measure saw blade power input, heat-treated alloy steel gearing and drive shafts, and large ways.

Retrieving Mechanism Improves American Broaching Machine

American Broach & Machine Co., Div. of Sundstrand Machine Tool Co., Ann Arbor, Mich., has improved its Model T-24 three-way broaching machine by the addition of a hydraulically operated broach retrieving mechanism, thus permitting the operator to have both hands free for manipulation of the machine. Retrieving mechanism is mounted above the machine column, having its own slide and hydraulic cylinder, controlled and timed to operate in proper relation to the main operating cylinder.

In operation, the part is loaded onto the work bushing and the machine cycle started by an operating lever. The retrieving head carries the broach down through the work and into the pull-head. The main ram then automatically begins downward travel, pulling broach through the work. At the end of the stroke, trip levers in the work table eject the



work and the machine slide begins the return stroke. At the end of this stroke, the broach is picked up by the retrieving head and automatically carried back to the starting position. Once the machine is loaded and the cycle started, operation is automatic.

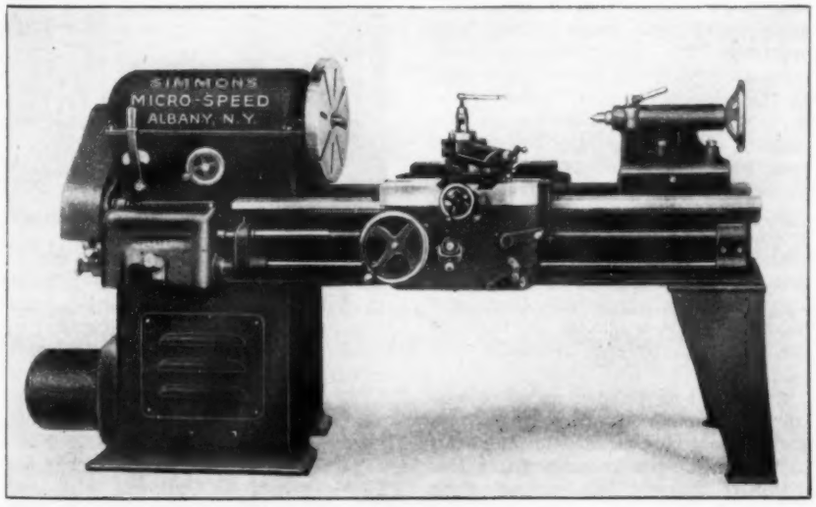
"Micro-Speed" Drive of Simmons Heavy-Duty Lathes Provides 1,000 Speeds Without Gears or Clutches

Maximum flexibility of spindle speeds without any gears or clutches is achieved through the use of the "Micro-Speed" drive on a new line of heavy-duty lathes developed by Simmons Machine Tool Corp., Albany, N. Y. This drive, installed in the cabinet-type leg, provides a virtually unlimited variation of spindle speeds by finger-tip control. Only a slight twist of the handwheel on the headstock gives a wide range of speeds. Change is instantaneous.

Headstock spindle is mounted in Timken precision tapered roller bearings. It is driven through multiple V-belts from the "Micro-Speed" drive unit, eliminating all speed-changing gears. Motors are integral with this unit itself.

Lathe bed is of semi-steel. Heavy sidewalls with double-walled cross girts add to rigidity. Gears in quick-change gearbox, quadrant, end gearing, apron and all feed mechanisms are accurately cut from forged steel blanks. A separate leadscrew and feed rod are provided to preserve accuracy of the leadscrew, which is in use only when cutting threads.

This lathe is built in 16- and 18-in. sizes in the style illustrated, and in 18- and 20-in. sizes of an extra heavy duty model. Specifications, respectively: swing over ways, 16, 18, 18 and 20 in.; swing over carriage, 11, 13, 14 and 15 in.; distance between centers on 6-ft. bed, 30, 30, 28 and 28 in.; weight, 3,300, 3,500, 4,300 and 4,600 lb.



Pipe Gasket Replacement Simplified With "Flange-Jacks"

Replacement of gaskets in flange pipe lines is claimed to be done faster, easier, more safely and more economically with the use of a pair of "Flange-Jacks" introduced by Garlock Packing Co., Palmyra, N. Y. With these jacks, pipe joints are claimed to be opened quickly even

when the working space is cramped, without damage to flange faces.

As the jack screws are tightened the flanges are separated gradually and evenly. There are no sparks caused by hammer blows, chisels or wedges, and no resulting vibration in the pipe line. After the new gasket is applied the joint is closed as easily as it was opened. Bolt holes are in perfect alignment and the gasket is properly positioned. There are no wedges to fly, and no jerking of the pipe which may cause leaks at other joints.

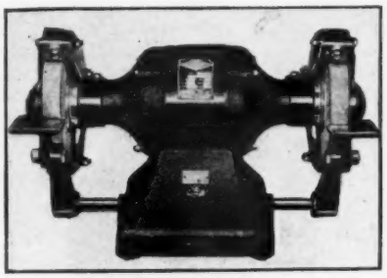
Jaws of these tools are heavy one-

piece steel forgings. Points of the steel screws are case hardened. "Flange-Jacks" are available in three sizes: for pipe sizes under 2 in., for standard flanges from 2 to 20 in. inclusive, and for standard flanges from 14 to 48 in. inclusive.

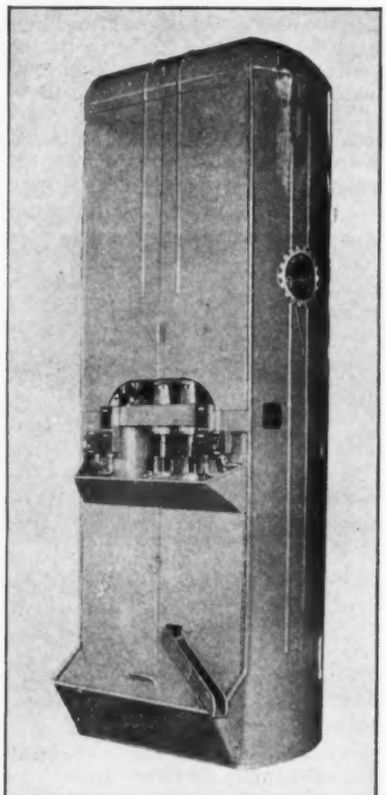
"Thor" Electric Bench Grinders Built for All-Round Service

Three new "Thor" electric bench grinders developed by Independent Pneumatic Tool Co., 610 W. Jackson Blvd., Chicago, Ill., have been substantially built for all-round service in grinding, buffing and wire wheel work. The 6-in. light duty (B-66), the 6-in. heavy duty (B-6), and the 7-in. heavy duty (B-7) all have completely enclosed ball bearing motors.

All sizes are provided with adjustable tool rests and permit attachment of safety glass eye shields. Wheel guards on the Models B-6 and B-7 are extra heavy and are of the enclosed type with chutes. Models B-66 and B-6 are of the split-phase start, induction-run type, while the Model B-7 is of the capacitor-start, capacitor-run type, with an oil-filled condenser in the base.



Greater Accuracy in Finishing External Spur Gears Achieved by American Broach & Machine "Gearbroacher"



American Broach & Machine Co., Div. of Sundstrand Machine Tool Co., Ann Arbor, Mich., has developed a machine for broaching external teeth of spur gears, which is claimed to achieve greater accuracy and higher production than theretofore possible. Known as the "Gearbroacher," this machine broaches every tooth in the gear at a single stroke, and allows for individual sharpening and adjustment of each broach, which cuts only a single tooth space.

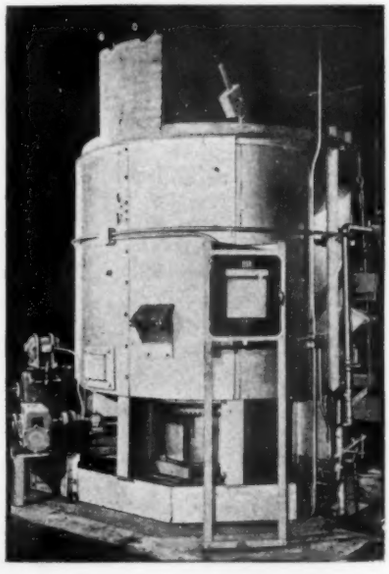
Machine itself is built of a cylindrical welded steel column which provides greater rigidity than is usually found in square or rectangular columns. Two chambers are provided in the front section of the column, one below the work table and one above. The one above is provided with a crosshead of considerable span which is accurately machined and fitted into hardened and ground way caps, the way caps being bolted on the scraped surfaces in the column proper. Crosshead is on a common center with ways, without any overhang. The lower chamber contains two cylinders, one on each side of the broach elevator. These cylinders receive their pressure on the bottom, thus using the full piston area when cutting. Cutting stroke of the machine is on the up stroke. The two cylinders are suspended from a ground steel work plate. This construction eliminates packing glands, thus eliminating packing leaks, and also providing a machine that only has one packing gland on the low pressure side of the hydraulic circuit.

Crosshead is hollow, allowing two tubular members to pass through it and through the automatic pull head to the master work head. These two members support the master work head, taking most of the pressure exerted against it by the broaches. They also serve for a lubricant passage, as lubricant is forced through these tubes at a high pressure, with openings in the master work head to give positive lubrication to each tool. Machine shown is arranged for broaching two gears at a time, there being two complete sets of tools and fixtures.

Rear of the machine houses the electric motor, hydraulic pumping unit, hydraulic circuit and hydraulic valves. Oil reservoir is in the lower part of the column with the motor above, all accessible through a rear door. Machine is provided with a sight oil level. Filling of oil reservoir is through rear door. Machine is equipped with electrical control, permitting it to operate on a full-automatic cycle for continuous operation or on a semi-automatic cycle. Machine shown is known as No. 2 "Gearbroacher," and is made in tonnage capacities of 8, 12 and 16 tons.

Mahr Heat-Treating Furnace Uses Center Firing Principle

A new type of rotary forging and heat-treating furnace developed by Mahr Mfg. Co., Div. of Diamond Iron Works, Inc., Minneapolis, Minn., claims several advantages through the use of a single burner center firing principle. This burner, located at the bottom of the hearth, fires up through a long combustion cone of special design. This cone insures that the products of combustion come into equilibrium before coming in contact with the steel, thereby minimizing scale and decarburization.



The center firing principle is also said to provide a furnace free from cold spots, and to make possible close control over the furnace atmosphere. Furnace can be equipped with full

6TH Carboloy Announces PRICE REDUCTION!

Plus New "Universal" Standard Tools For 80% of all Turning, Boring, Facing Jobs

Since the year when Carboloy tools were first introduced it has been the expressed aim of Carboloy Company to pass on to industry savings resulting from increased consumption and manufacturing efficiencies. As a tangible result of this policy, five major price reductions were put into effect between 1929 and 1939.

For a number of years, however, we have realized that if our ultimate goal of reducing the price of Carboloy cutting tools to a level that would make them available for the widest possible use, mass production methods of manufacture, through greater standardization, would have to be effected.

Towards this end one of our major activities has been to determine the minimum number of grades and the simplest line of tools that would be applicable to a substantial majority of carbide tool applications.

New $1,000,000 Plant Part of Program

Concurrent with this we inaugurated a long range program of manufacturing development to establish maximum efficiency for standardized production. This culminated in the expenditure of a million dollars on a new plant and equipment completed last spring, having a production capacity of ten times the amount of cemented carbide then consumed by industry, with provisions for expanding metal production to many times that amount.

Mass Production of Standard Tools Now Possible

Today we are happy to announce that this program has been completed. One of the outstanding results of this program now made available to industry is a line of standardized tools at prices that would have seemed beyond the realm of possibility only a few years ago. Indicative of the extent to which standardization has been developed is the fact that these tools—covering 80 per cent of all carbide tool requirements—comprise but five styles in only three grades—two for cast iron, and one for steel.

General Price Reduction on Carboloy Metal

A further result of this standardization program is that—because of the anticipated wider scale use of carbide tools—the cost of producing basic cemented carbides can be reduced to such an extent that we are able to announce the sixth general price reduction on carbide metals. This affects special tools, dies for working wire, bar, tubing and sheet metal, Carboloy wear-resistant inserts, etc., in proportion to the amount of Carboloy metal used in each product.

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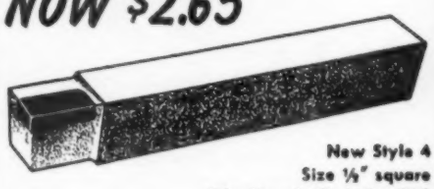
✓ Check These NEW Standard Tool Prices Against Any Other Cutting Alloy!

(Three styles illustrated)

~~$6.82~~

NOW $2.65



New Style 4
Size ½" square
(⅛ x 5/16 x ⅜ Carboloy Tip)

~~$8.66~~

NOW $3.95

New Style 13
Size ⅝" square
(5/32 x ⅜ x ¾ Carboloy Tip)

~~$9.58~~

NOW $4.70

New Style 1
Size ⅝" square
(5/32 x ⅜ x ⅜ Carboloy Tip)

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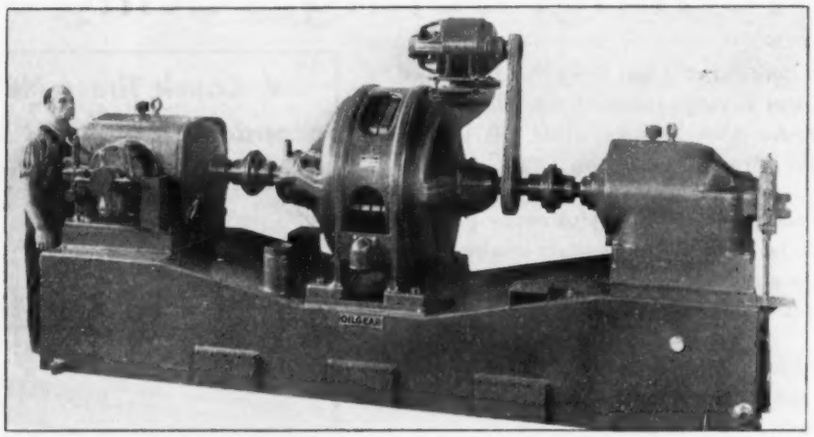
TANTALUM CARBIDES

automatic temperature control and with an individual low pressure blower to make it a self-contained unit. Positive pressure within the furnace is maintained by an automatic "Vent-O-Matic" stack damper.

The rotary table is gear driven through a variable-speed transmission. Furnace is equipped with an improved type of sand seal having filling chambers to maintain sand seal depth. A special type of door equipped with air curtain protects operator from heat. Heavily insulated throughout and supported by a rugged steel framework, the furnace is manufactured in hearth diameters ranging from 4 to 9 ft., for operation on either oil or gas, at temperatures from 1,400 to 2,500 F.

Oilgear Two-Way Variable Displacement Pumps Developed for Use With Pushbutton Control

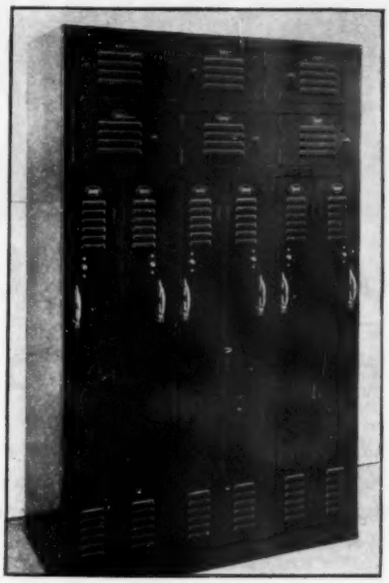


Two-way, three-position, variable displacement pumps have been developed by The Oilgear Co., 1302A W. Bruce St., Milwaukee, Wis., especially for use with remote pushbutton control. Available in sizes from 2 to 150 hp., these Type DX pumps are of the heavy duty, radial rolling piston type.

Practically each pump size is available with internal mechanisms for normal working pressures of 1,100, 1,700 and 2,500 lb. per sq.in. and for peak pressures up to 3,000 lb. per sq.in. All pumps are arranged for flange mounting to a separate reservoir base, or with an integral reservoir. They are equipped with built-in auxiliary gear pumps for supercharging the high pressure unit, for operating the pump control mechanism and for auxiliary purposes. Also included are a gear pump relief valve, dual reverse flow high pressure adjustable relief valves, and two-way automatic suction and discharge valves integral with the pump case.

Compact, integral control makes it possible to reverse the oil flow direction and also to select the neutral position from a remote pushbutton station, or by means of switches. Since oil flow is reversed in the pump, no external control valves are required. Illustrated is the Type DX-15025 pump in combination with a Type C15025 pump on a large reservoir base direct connected to a double-end 250-hp. d.c. motor. These units provide a combined delivery of 50,000 cu.in. of oil per min. at peak pressures up to 3,000 lb. per sq.in. for operating a 150-ton high speed hydraulic deep-drawing press having a 60-in. stroke.

These DX pumps are now standard equipment on all Oilgear broaching machines. Ease of operation, accurate control of volume, smooth acceleration and deceleration of oil flow, automatic protection against overload and automatic lubrication of working parts, make these units especially suitable for operating push and pull broaching machines, and for driving forming, assembling, forcing, broaching, extruding and speed presses.



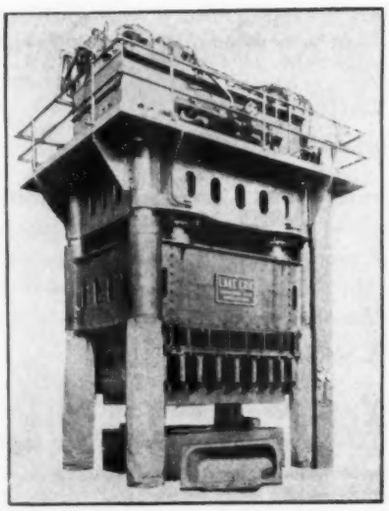
Two-in-One Steel Lockers Require Less Floor Space

Two-in-one steel lockers offered by Penn Metal Corp. of Pennsylvania, 36 Oregon Ave., Philadelphia, Pa., have been designed especially for use in cramped quarters. Illustrated is a group of three lockers which afford ample accommodations for six persons.

Each locker is 15 in. wide, 21 in. deep and 73½ in. high, and is divided into two coat compartments, each of which is 7½ in. wide, 21 in. deep and 54 in. high. The two hat compartments are each 15 in. wide, 21 in. deep and 9 in. high.

Frame members are spot welded for strength and rigidity. All nuts and bolts are cadmium finished to resist corrosion. Rubber bumpers are used at contact points to prevent doors from banging.

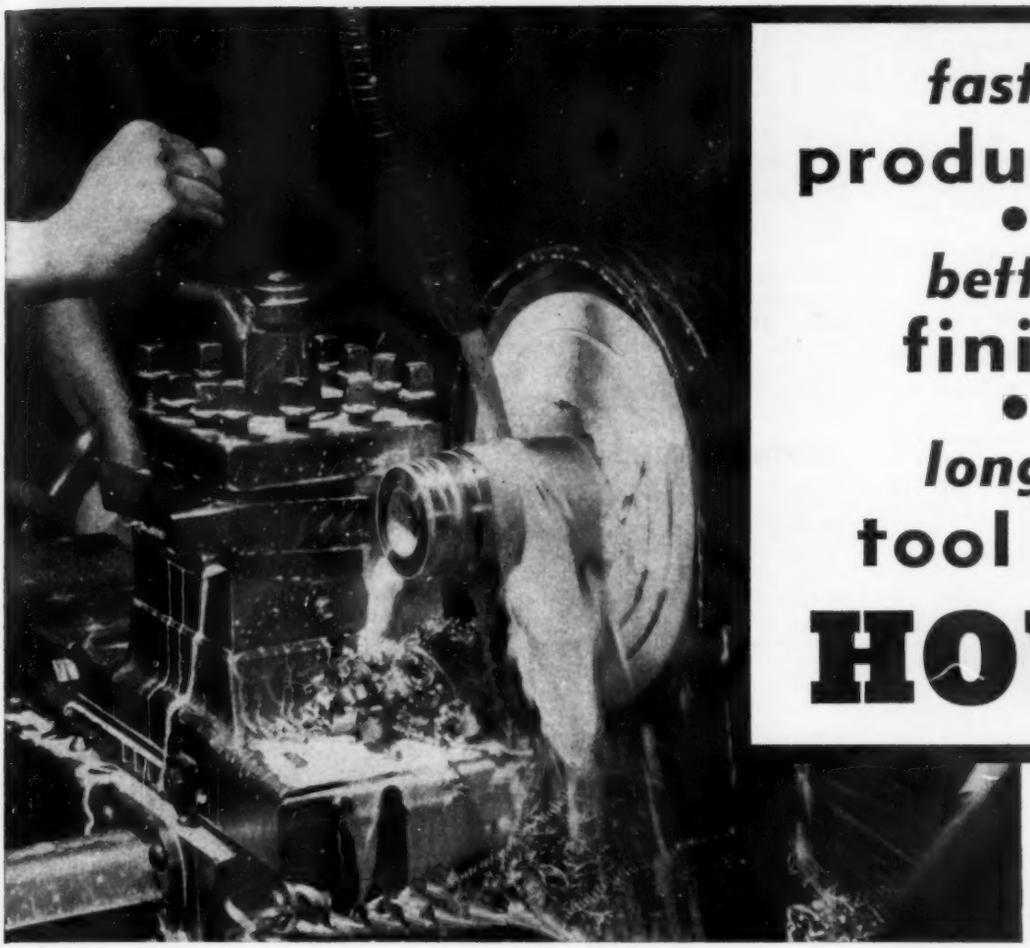
1,700-Ton Double-Slide Hydraulic Press Manufactured by Lake Erie Engineering



Claimed to be the largest of its type made in America, a 1,700-ton double-slide hydraulic press has been developed by Lake Erie Engineering Corp., Buffalo, N. Y. This press is designed to exert a pressure of 900 tons on the blank-holder and 800 tons on the main ram.

One of the operations successfully performed on this press is the production of steel bath tubs, illustrated. In this application the high hold-down pressure eliminates wrinkling of the edges of the sheet when forming the part without the use of draw beads. Tubs are formed cold from 65x79-in. 14-gage sheets in a single operation.

Press has a speed of several cycles per minute. Typical installation is with top of bed located at floor level. Vertical columns are covered by flex-



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ible fabric boots, giving protection against abrasive dust resulting from dressing dies.

Entire press is self-contained with pumping unit mounted on top. Operation is controlled by centrally located pushbuttons. Adjustable pressure control of blank-holder and main ram is provided. Daylight opening is 98 in., and stroke is 37 in. Cushioned bed measures 160x106 in.

"Flextite" Leak-Stopper Requires Few Seconds to Set

The Flexrock Co., 2300 Manning St., Philadelphia, Pa., has developed a new active ingredient which, used in "Flextite," brings its activity down to a matter of seconds. This improved compound is used with ordinary

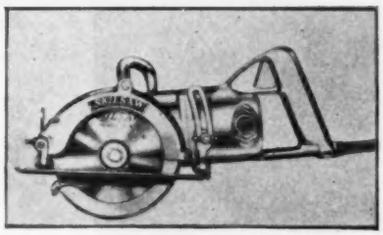
portland cement. In use it is forced against water pressure, held there a few seconds, and the leak is stopped.

"Flextite" is claimed to be invaluable for stopping leaks in dams, retaining walls, dykes, concrete structures holding water at irrigation plants and reservoirs, and in concrete tanks and other such places. It is also used for waterproofing and damp-proofing cellars, basements, pits, tanks and similar locations.

6-In. Portable Skilsaw Designed for Heavy Duty

The Model 67 portable electric saw has been developed by Skilsaw, Inc., 5022 Elston Ave., Chicago, Ill., especially for heavy-duty service. This 6-in. saw is more compact than previous models and is said to be ideal for general remodeling work and for intermittent maintenance sawing.

This machine may also be used with abrasive disks for scoring tile, concrete, etc. It cuts to a depth of 1⅞ in., and will rip and cross-cut hard wood up to 1 in.; cross-cut dressed pine lumber up to 2 in., and bevel cut lumber 1 3/16 in. thick at 45 deg. Blade has a free speed of 3,400 r.p.m., and is protected by an automatic telescopic guard that ro-

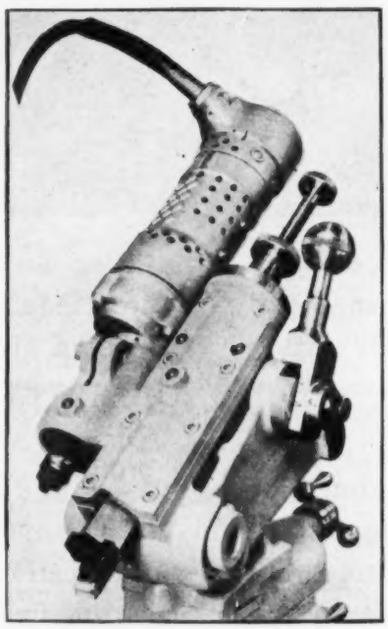


tates on ball bearings. Base is easily adjustable for depth and bevel cutting. All moving shafts are mounted on ball bearings for quiet operation and long life. Tool is 15½ in. long and weighs only 11½ lb.

Superfinishing Attachment Surfaces Small Diameters

The Size O light duty superfinishing attachment offered by Foster Machine Co., Elkhart, Ind., has been designed for mounting on the lathe compound or cross slide for superfinishing fractional-inch diameters.

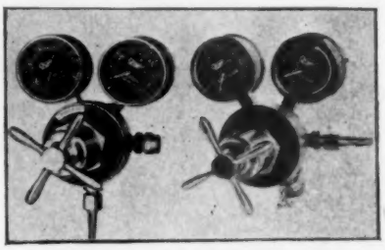
Stone pressure is provided by a very sensitive, easily adjusted spring.



Stone is retracted by a lever which does not disturb stone setting. Oscillation is imparted to the stone in a straight line movement by small gearmotor.

Three Single-Stage Regulators Offered by Linde Air Products

Linde Air Products Co., a unit of Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y., has added three single-stage, general service regulators to its Oxweld line of welding and cutting apparatus. These regulators, the R-80 oxygen regulator for delivery of oxygen at working pressures up to 200 lb., the R-81, its companion acetylene regulator, and the R-82 fuel gas regulator, feature simplicity of design and reliability of operation. They are strongly built and are designed to give dependable performance in all welding, cutting, and deseaming operations where simplicity of construction and large ca-



pacity are demanded, but where the refinements of two-stage regulators are not required.

The R-80 and R-81 regulators are of the stem type, the valve closing with incoming pressure, thus assuring positive seating action. Materials used for valve seats are selected for efficient service and long life. Passageways are of sufficient size to permit unrestricted flow of gases. In addition, the R-80 oxygen regulator has a special inlet screen formed of a double thickness of fine mesh to filter out dirt and foreign particles. Since the R-80 and R-81 have only a few working parts, the occasional maintenance which may be required can be performed quickly and inexpensively.

The R-82 fuel gas regulator also is of the stem type and is for use with various other gases, such as Pyrofax, propane, and butane. It has the same operating advantages and construction features as the R-81 acetylene regulator.

Additional Filter Cartridge Made For Basic Respirator

American Optical Co., Southbridge, Mass., has made available another filter cartridge for its versatile R-1000 respirator, thereby providing five

interchangeable types of protection in one basic unit. The new filter gives protection against toxic dusts formed by crushing, grinding and abrading such solids as lead, cadmium, arsenic, chromium, manganese, selenium, vanadium and their compounds.

The other four filter cartridge previously available provide protection against: (1) pneumoconiosis-producing dusts like quartz, asbestos, ores, coal, flour, etc.; (2) low concentrations of fumes, vapors or gases encountered in paint spraying, and other light organic vapors; (3) low concentrations of acid fumes and gases; (4) low concentrations of combined acid-organic gases and vapors.

Post Transparent Medium Takes Pencil Like Ink

Ink-like opacity from hard drawing pencils is provided by "P.T.M." transparent medium developed by Frederick Post Co., P. O. Box 803, Chicago, Ill. This medium, not a tracing cloth and not a vellum, is said to produce ink results at pencil speed.

Blueprints made from drawings produced from ordinary hard drawing pencils on this new medium have a solid background and sharp white lines. On "Blacline" prints the detail is solid and sharp, with the background uniformly white. Both the opacity of the pencil detail due to the drawing surface and the extreme transparency of the drawing base contribute to the superior printing results.

Further advantages include exceptional strength and body. Compared to the best vellums it has from 2 to 10 times the wet tensile strength and from 10 to 50 per cent greater tear and burst resistance. The reverse side is dust protected by a glazed finish similar to the reverse side of tracing cloth. The surface is moisture-proof, and cost is less than one-third of the price for tracing or pencil cloth.

Standard rolls are 20 yards long and 30, 36, 42 or 54 in. wide. The medium is also available in plain sheets or printed.

Two Insulated Welding Gloves Announced by American Optical

Two welding gloves, insulated for heat protection and reinforced for long life, have been made available by American Optical Co., Southbridge, Mass.

The TX100 glove is said to present a new idea of comfort, quality, workmanship and wear. Made from good grade chrome tan horsehide to a "gun-cut" pattern, this glove has no seams exposed to active wear. All are at the back of the fingers, except at the base of the second and third fingers, and these seams are welt reinforced. Thumb and index finger are also reinforced. Back of the

Advertisement

Manufacturers Look to Steel Warehouses for Quick Defense Requirements

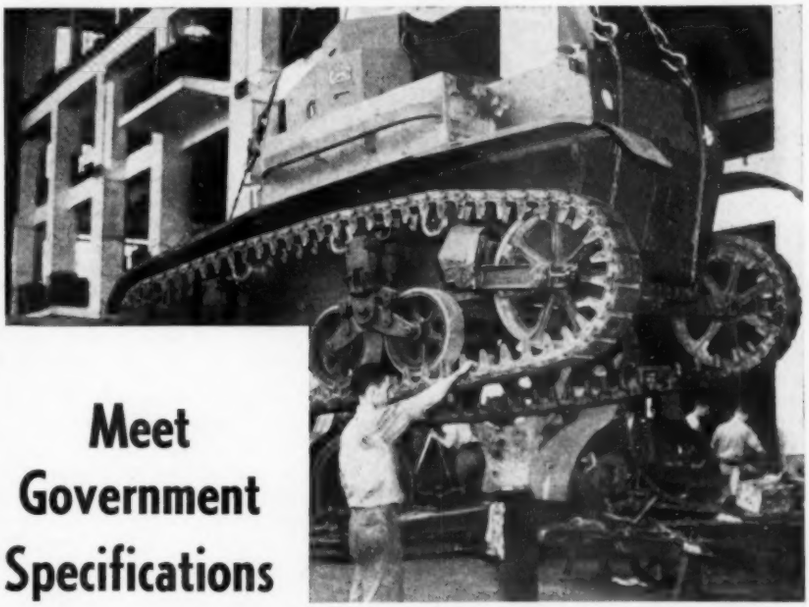
Suddenly spotlighted by snowballing demands for adequate defense of America, machinists, tool craftsmen, and engineers are keenly aware of their crucial position in American industry. Without heroics, they realize that a good lathe hand is now much more important in the preservation of the American way than a fully trained soldier.

And, like most Americans, those employed in the metal working field are straining mightily to fill the gap between materials "on order" and equipment ready for action.

But the hurly-burly and press of emergency often defeats its own end. The sudden transition from idling along at ¾ speed to wide open throttle creates new problems of steel supply and delivery. Ultra-rigid specifications, too, must be met and mastered.

As in World War I, when Joseph T. Ryerson & Son, Inc. received the War Department award for distinguished industrial service, Ryerson is fully equipped to handle quickly and efficiently steel demands for national defense.

Ryerson certification of steel for quality—a vast range of stocks for quantity—and immediate shipment for speed, will help you win your production war without waste. (See Ryerson ad below.)



Meet Government Specifications with RYERSON CERTIFIED STEELS

When you're working on orders for defense, government steel specifications are no problem . . . if you buy *Certified* Steel from Ryerson!

Under the Ryerson Certified plan, you get steels made to narrow, close-range specifications. You get accurately identified steel of known analysis . . . steel you can depend on to meet government requirements. It is also easier to pass inspection on the finished job if Ryerson Certified Steel is used. All Ryerson Steels are closely controlled as to chemical content, accuracy and finish without the slightest increase in cost to you. A special quality control plan on Alloy Steels assures uniform heat treatment response.

And deliveries are no problem if Ryerson is your source. Enormous stocks . . . over 10,000 kinds, shapes and sizes . . . in ten conveniently located warehouses, are ready for immediate shipment. Practically every order is on its way the day we get it. Get acquainted now with this worry-free, superior Steel-Service, if you are not already a Ryerson customer. Stock List and any special information sent promptly on request.

Joseph T. Ryerson & Son, Inc., Chicago, Milwaukee, St. Louis, Cincinnati, Detroit, Cleveland, Buffalo, Boston, Philadelphia, Jersey City.

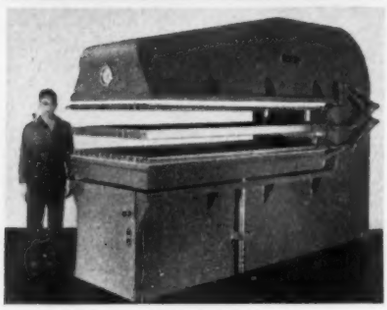
RYERSON CERTIFIED STEELS

RYERSON

SPEED UP YOUR WELDING OF HIGH STRENGTH—LOW ALLOYS WITH

MUREX

ELECTRODES



Welded machine frame built by Farrell-Birmingham, Ansonia, Conn.

SPECIALLY DESIGNED FOR CARBON-MOLY, COR-TEN, MAYARI, CROMANSIL, 2%-3% NICKEL AND OTHER STEELS

The Murex line includes a group of specially developed rods designed to produce welds with tensile strengths ranging from 70,000 to 100,000 lbs. per sq. in.; ductilities of 20% to 30% and corrosion and heat resisting qualities matching closely any of the more widely used new steels. Because of their excellent deposition rates at high amperages, their ease of handling by skilled welders, and the assurance they provide of cleaner, smoother deposits they step up welding speeds and help hold down costs.

Ask to have Murex Electrodes demonstrated on your high strength—low alloy applications. A note to the nearest M & T office will bring a representative promptly.

METAL & THERMIT CORPORATION
120 Broadway, New York, N. Y.

Albany • Chicago • Cincinnati
Detroit • Minneapolis • Pittsburgh
So. San Francisco • Toronto

glove is one piece, removing any chance of seam breakage under extreme heat. Inside is insulated with wool.

The other glove, of slightly different design, is made on the "gun-cut" pattern from carefully selected chrome tanned horsehide, with a seamless palm. All seams of this No. 3015 glove are at the back of the fingers, where they are not exposed to wear, except for welt-reinforced seams at bases of second and third fingers. Differences in design from the No. TX100 glove are that the thumb and index fingers are reinforced, and that the back is reinforced with an outside patch.

NEW MATERIALS

Special Finishes Developed For Infra-Red Baking

A line of finishes developed especially for use with infra-red baking equipment has been announced by Ault & Wiborg Corp., Dana & Thomas Aves., Cincinnati, Ohio. Formulas include both under coats and top coats in a full range of plain colors with no limitation as to lustre. A hammered effect and various wrinkle finishes are also available. All finishes are claimed to maintain satisfactory characteristics of hardness, flexibility, durability and adhesion.

In many cases baking time is cut to one-half, and in several instances to one-third, by the use of these finishes in conjunction with infra-red drying. They can be used successfully on such articles as household appliances, auto parts, cabinets, and other metal products requiring an excellent finish.

Superior Physical Properties Claimed for Aluminum Alloy

Exceptionally good physical properties are claimed for the "T-1" aluminum alloy developed by National Bronze & Aluminum Foundry Co., E. 88th & Laisy Ave., Cleveland, Ohio. Among these properties are tensile strength up to 33,000 lb. per sq.in. without heat-treatment, good machineability, and ability to be welded without loss of physical properties.

Foundry practice is virtually the same as for other aluminum alloys. Since no quench is used, castings are free from internal stresses. For the same reason the alloy can be welded without loss of physical properties.

Percentages of ingredients in "T-1" alloy are approximately as follows: copper, 2.0; tin, 1.5; magnesium, 0.7; zinc, 1.0; titanium, 0.2; chromium, 0.2; and the balance aluminum. Specific gravity is 2.78. Ultimate strength ranges from 30,000 to 33,000 lb. per sq.in., yield strength (elastic limit) from 16,000 to 25,000 lb. per sq.in., percentage elongation from 6 to 10, and Brinell hardness from 60 to 78.

TRADE PUBLICATIONS

ALLOYING METALS A 16-page booklet which describes the effects of alloying elements, their characteristics, applications, and heat-treatment has been published by the International Nickel Co., Inc., 67 Wall St., New York, N. Y.

BRACING MATERIALS Signode Steel Straping Co., 2600 North Western Ave., Chicago, Ill., has issued a four-page illustrated pamphlet which describes the use of steel strapping as an effective method of protecting carloads of cartons, boxes or bags in transit.

CLEANERS A four-page folder circulated by Homestead Valve Mfg. Co., Coraopolis, Pa., illustrates and describes the uses of steam cleaners.

CONTACTORS Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., is curculating a four-page illustrated booklet which describes a heavy duty d.c. magnetic contactor.

CYLINDERS AND TANKS Four-page bulletin No. 308 circulated by Wm. B. Scaife & Sons Co., Oakmont, Pa., tells of a method to reduce maintenance cost of cylinders and tanks.

FACING ALLOYS Catalog No. 72 circulated by Wall-Colmonoy Corp., 636-7 Buhl Bldg., Detroit, Mich., provides information regarding hard facing alloys and overlay metals for maximum resistance to wear and corrosion.

FANS Four-page bulletin No. 206, circulated by Autovent Fan & Blower Co., 1805-27 N. Kostner Ave., Chicago, Ill., offers diagrammed illustrations which indicate the operation and application of All-Vent Fans.

FOUNDRY EQUIPMENT Catalog No. 60 circulated by the American Foundry Equipment Co., Mishawaka, Ind., contains 12 pages of illustrations and descriptions of the entire line of products manufactured by the company.

HEAT EQUIPMENT York Oil Burner Co., Inc., York, Pa., provides two specification sheets which describe the construction and operation of high pressure boiler burner units.

METAL THICKNESS A test of electro-deposit thickness of zinc, cadmium, tin and copper is described in a new technical service manual issued by E. I. du Pont de Nemours & Co., Wilmington, Del.

MOTORS A two-page illustrated leaflet No. F-8533 is offered by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., to describe constant

speed direct current motors in either shunt or compound type.

MOTORS A four-page illustrated leaflet No. 3105, which describes totally-inclosed, fan-cooled squirrel cage motors is being circulated by Dept. No. 7-N-20 Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

PUMPS Catalog No. 939 issued by George D. Roper Corp., Rockford, Ill., tells a non-technical story of uses, installations, etc. of pumps.

PYROMETERS Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia, Pa., has published Broadsides Nos. N-33 and T which provide information regarding pyrometers and heat-treating furnaces.

SAFETY CLOTHING Industrial Gloves Co., 900 Garfield Blvd., Danville, Ill., describes and gives prices of its industrial clothing in an 18-page booklet.

SAFETY SHOES Catalog No. 9, issued by Lehigh Safety Shoe Co., Inc., Allentown, Pa., contains a "Safety Shoe Buyers' Guide" section which explains safety shoe construction features.

SEALING B. F. Goodrich Co., Akron, Ohio, has issued a new catalog section on Plastikon rubber putty, a material which has industrial and construction application because of its ability to maintain air-tight and moisture-proof seals.

SHAFT MACHINES Catalog No. 40 circulated by Stow Mfg. Co., Inc., Binghamton, N. Y., describes and illustrates various flexible shaft machines, hand pieces and angle heads, grinding wheels and buffs.

STEEL VALVES A 306-page book No. 40-S, devoted exclusively to steel valves and fittings has just been issued by Crane Co., 836 S. Michigan Ave., Chicago, Ill.

SWITCHES Micro Switch, Freeport, Ill., describes in Data Sheets Nos. 11 and 12 a compact, low-priced switch, for use where roller equipped pivoted arms are desired.

TAPS A four-page pamphlet, which illustrates, gives sizes and prices of precision taps is offered by Threadwell Tap & Die Co., Greenfield, Mass.

TOOLS Catalog No. 40 published by the Ready Tool Co., Bridgeport, Conn., contains a complete price list of ball bearing and high speed centers.

WEIGHTS AND DATA A book containing practical and complete tables of weights and data on copper, brass and bronze products has been published by Revere Copper & Brass, Inc., 230 Park Ave., New York, N. Y.

LUFKIN

CHROME FACE
"ANCHOR" STEEL TAPE

Here is the finest, steel tape designed especially for machinists. Its jet black markings are easy-to-read—even in poor or artificial light. Its satin chrome-white surface throws the markings in bold relief—and the surface cannot rust, crack, chip or peel. Unusually free from glare. Easy to clean. Folding flush handle is opened by a push pin. The genuine leather case and mountings are outstandingly durable. The tape is remarkably strong. Write for free catalog.

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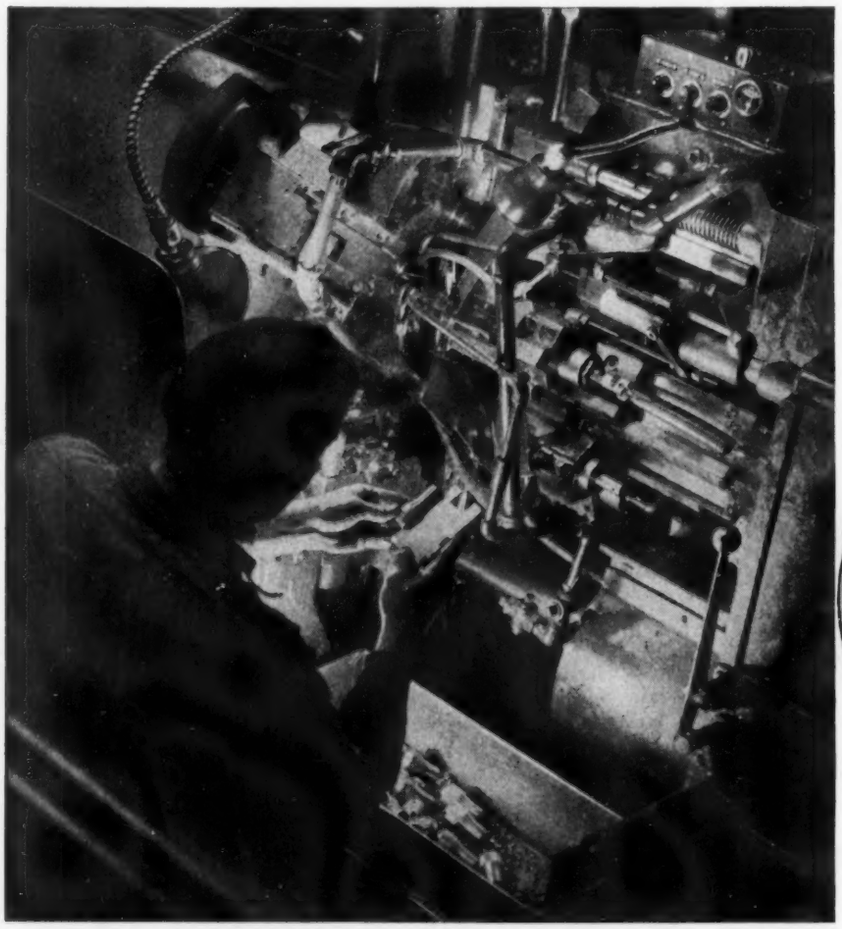
TAPES · RULES · PRECISION TOOLS

POINTERS ON THE CARE AND FEEDING OF A MACHINE

RULE No. 1 for getting best results from high-speed machines is to use AMERCUT Cold Finished Steel Bars. This product is available in a wide range of carbon steels and alloys which can be machined into an amazing variety of parts. The AMERCUT tag on the bars you buy assures you of a product that meets the highest standards of quality. The uniformity of these bars will save you money in reduced wear on tools and in faultless production of parts in many sizes and shapes that are accurate in all dimensions.

Our Sales Engineers will be glad to furnish you with full information concerning AMERCUT Bars in special sizes and shapes, and we are equipped to supply you from stocks on hand in any size round ranging from 1/32″ in diameter up to and including 6″.



ALWAYS LOOK FOR THE AMERCUT TAG ON YOUR COLD FINISHED BAR SHIPMENTS

AMERICAN STEEL & WIRE COMPANY

Cleveland, Chicago and New York

Columbia Steel Company, San Francisco, *Pacific Coast Distributors* — United States Steel Export Company, New York

UNITED STATES STEEL